FOLIICOLOUS MARINE NEMATODES ON TURTLE GRASS, *THALASSIA TESTUDINUM* KÖNIG, IN BISCAYNE BAY, FLORIDA[1]

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ABSTRACT

The ecology and taxonomy of foliicolous nematodes on turtle grass, *Thalassia testudinum* König, has been studied and characterized at four separate sites in Biscayne Bay, Florida. Differences in speciation and population levels between sites, and within individual sites as affected by physical and seasonal factors, are noted. A basic homogeneity exists similar to that found in previous studies, *i.e.*, dominance of chromadorids and uniformity of feeding type while the specific composition at each site displays a measure of uniqueness. Examples are noted which lend support to Wieser's principle of alternate species. A key to the most commonly encountered species is presented, along with descriptions of identified nematodes and new habitat ranges. Four heretofore undescribed species are established: *Chromadorina epidemos*, *Hypodontolaimus pilosus*, *Monhystera ocellidecoris*, and *Monhystera dubicola*.

INTRODUCTION

Turtle grass, *Thalassia testudinum* König, occurs in extensive beds in Biscayne Bay, Florida, and provides one of the largest single ecological habitats of Western Atlantic tropical shallow waters (Phillips, 1960; Moore, 1963). The importance of this plant in marine productivity and as a community for a diverse range of invertebrate animals and associated flora has been well documented (Voss & Voss, 1955; Ginsburg & Lowenstam, 1958; Humm, 1964). The latter worker noted that "*Thalassia* leaves serve as a suitable, sometimes ideal substratum for the attachment and growth of a wide variety of algae, invertebrates, and various microscopic organisms." In addition, mycological studies (Meyers, Orpurt, Simms, and Boral, 1965) have revealed an abundant fungal biota associated with *Thalassia* throughout the various stages of leaf growth. In other correlated microbiological work (Meyers & Hopper, 1966) the bionomics of the omnivorous nematode species, *Metoncholaimus scissus* Wieser & Hopper, 1967, within the upper sedimentary layers of turtle grass communities has been documented.

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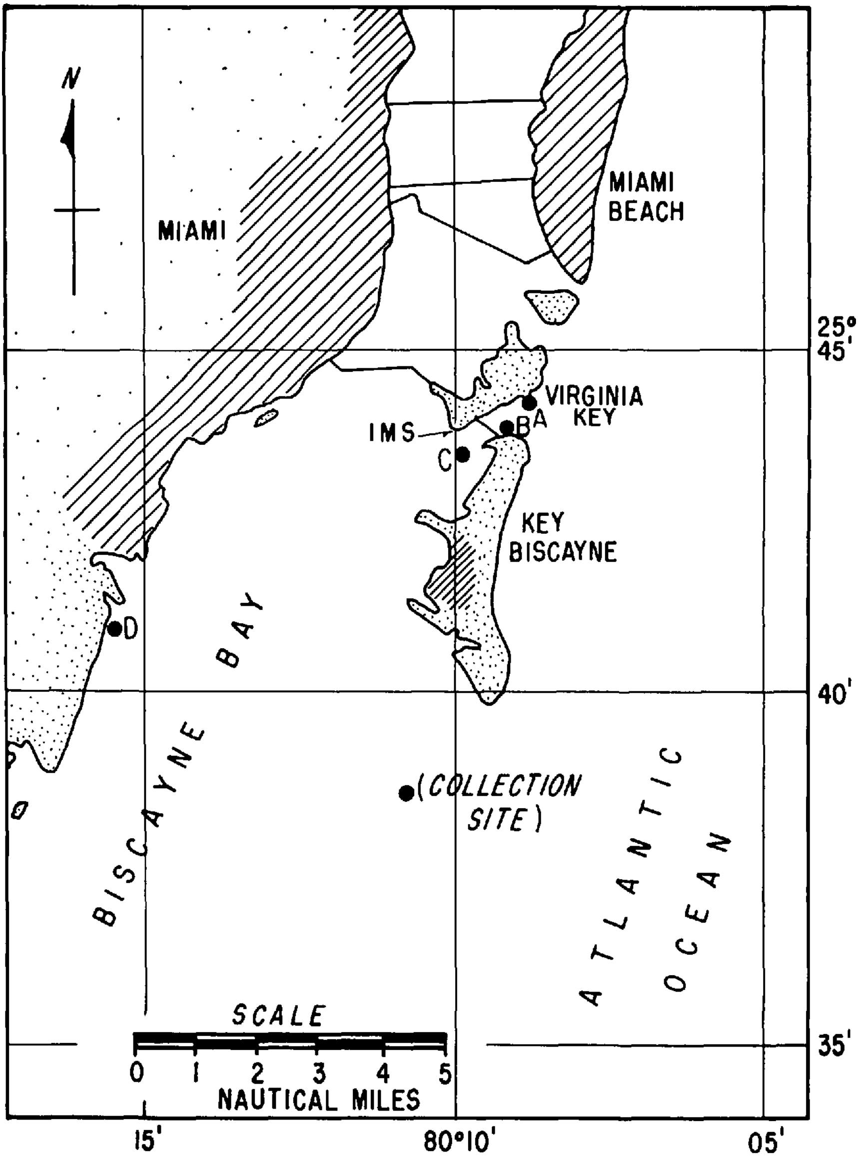


FIGURE 1. Location of collection sites in Biscayne Bay, Florida.

While the abundance of nematodes in the sea has been frequently reported, comparatively little is known about the ecology of the nematode fauna associated with various marine algae, especially in the North American area. In the scattered papers from the latter region, the primary emphasis has been taxonomical (*i.e.*, Cobb, 1920; Chitwood, 1951; Timm, 1952; and Wieser & Hopper, 1967). Considerably more information is available on the algal-associated nematodes in European waters, mainly through the investigations of Wieser at Plymouth, England (Wieser, 1951, 1952) and in various works dealing with the Mediterranean Sea (Allgén, 1942; Schuurmans-Stekhoven, 1942, 1942a, 1943, 1950; Wieser, 1954, 1954a, 1955, 1959). The latter study by Wieser is of particular interest in that it summarizes the ecology of the marine algal fauna with special attention to the Mediterranean Sea.

In conjunction with an overall investigation of mycological and nematological processes within subtropical seagrass habitats, a series of studies was initiated in 1963 at the Institute of Marine Science to characterize the nematode biota on *Thalassia* leaves at different sites in Biscayne Bay, Florida. A total of four seagrass locales were examined, with one area studied in detail to ascertain possible seasonal fluctuation in the foliicolous nematode population. For, in spite of aforementioned investigations of marine nematodes in various regions of the world oceans, little is known about the population dynamics of these omnipresent animals within well defined sectors of the marine environment. Results of this ecological and taxonomical work are reported below.

We wish to acknowledge the invaluable technical assistance of Mrs. J. Simms and Mrs. L. Hoyo of IMS throughout the collection phase of this study and of Mrs. M. Walker of the Canada Department of Agriculture in the preparation of the nematode material for microscope examination.

METHODS

Collection area.—A total of 30 separate collections were made from December 1964 at four sites in Biscayne Bay (Fig. 1). The majority of the collections were from Site A at Virginia Key. This site, 100-200 yards from the Virginia Key beach, is within a dense and luxuriant stand of turtle grass. The area is subject to regular wave action and is characterized by a fairly hard-packed sand bottom with little detrital accumulation on the leaves, except when occasional turbidity causes deposition of particulate material. Site B, off the northwest shore of Key Biscayne in Bear Cut, is swept by strong tidal action with little sedimentation on the *Thalassia* leaves. Site C is within a well defined grass flat off the western shore of Key Biscayne. This locale is fairly sheltered with a very soft "ooze-like" bottom of a fine loose sandy silt with large quantities of small shells. It is covered by approximately two feet of water at low tide. The fourth collection area, Site D, at Matheson Hammock, was selected for comparative purposes. Site D, separated by a distance of approximately 5-6 miles from A, B, and C, is within a region of heavy mangrove development with only moderate tidal flow. The *Thalassia* at D is nearly exposed at low tide, covered by only six inches of water. Earlier unpublished ecological observations from this laboratory suggest that the general faunal characteristics of the Matheson Hammock region differ considerably from the plant communities in other areas of the Bay.

Collection procedure.—When possible, collections were made at Sites A, B, and C on the same day to allow a better comparative study. Leaves were collected at random, transported from the collection area in plastic bags in sea water, and examined and treated as noted below within one hour. Often as many as 50 entire leaves were taken for subsequent treatment in the laboratory.

Collections were made by hand facilitated by the use of face mask and snorkel. The grass flats were examined regularly to establish the *in situ* condition of the *Thalassia* and the nature of the epigrowth. While seasonal development of epiphytes was not recorded, we nevertheless did attempt to relate general characteristics of the leaf sample with the overall condition of the plant community.

Isolation techniques.—Each sample consisted of the total scrapings from 10 blades. The composite epigrowth material of the sample was collected in sea water in depression dishes, checked for nematode activity, and preserved using standard procedures of heat (60°C) followed by suspension in 4 per cent formalin buffered with sea water.

Characterization of the nematode fauna.—The majority of the quantitative determinations were based on 1:10 aliquots of the sample except in a few collections where large concentrations of animals necessitated greater dilutions. In those samples with few nematodes, the entire undiluted sample was examined and tabulated.

Identifications were made of nematode species that were either commonly encountered or included male specimens. Juveniles of closely related species, and insufficiently known taxa, were classified either as "unidentified" or keyed to family, *i.e.*, desmodorid, oxystominid, chromadorid, etc. As noted subsequently, a majority of the unidentified forms have been found to be representatives of Chromadorida.

Permanent mounts of the various taxa have been prepared and are deposited in the Canadian National Collection of Nematodes, Ottawa, Canada.

Results and Discussion

Ecology.—The various collections at the four sites examined are tabu-

TABLE 1
RECORD OF COLLECTIONS

Site	Collection No.	Collection date
A—Virginia Key	568	Dec. 13, 1963
	571	Jan. 23, 1964
	574	Feb. 26, 1964
	582	Apr. 15, 1964
	589	May 21, 1964
	590	May 30, 1964
	591	June 12, 1964
	592	June 16, 1964
	595	July 15, 1964
	601	Sept. 4, 1964
	605	Oct. 20, 1964
	609	Nov. 11, 1964
B—Bear Cut	579	Mar. 24, 1964
	583	Apr. 21, 1964
	584	Apr. 21, 1964
	592	June 16, 1964
	594	July 10, 1964
	597	July 31, 1964
	600	Aug. 21, 1964
	602	Sept. 23, 1964
C—West Shore, Key Biscayne	603	Sept. 23, 1964
	604	Oct. 15, 1964
	606	Oct. 21, 1964
	607	Nov. 3, 1964
	608	Nov. 11, 1964
	611	Nov. 25, 1964
	613	Dec. 9, 1964
D—Matheson Hammock	593	June 26, 1964
	596	July 24, 1964
	599	Aug. 13, 1964

lated in Table 1. As noted, the majority of samples were from Sites A, B, and C, especially the former, with only three collections at Site D. The number and time period of collections at Site A permitted a seasonal study of the foliicolous nematode biota at this locale.

Data are compiled in Table 2 on percentage abundance and frequency of the nematode taxa at the four sites. Taxa are listed numerically in the order of their abundance at Site A. These data are presented diagrammatically in Fig. 2 wherein the first 15 nematode taxa represent species or species groups that comprise more than 5 per cent of the animals within a particular site or are found at three of the four sites. The remaining species are treated as a composite group (No. 16) in Fig. 2, and represent

TABLE 2
ABUNDANCE AND FREQUENCY OF NEMATODE TAXA AT THE FOUR COLLECTION SITES

		Individual sites								Total of 4 sites		
		A		B		C		D				
No.		Percentage abundance	Frequency	Percentage abundance	Frequency	Percentage abundance	Frequency	Percentage abundance	Frequency	Percentage abundance	Frequency	Feeding type
1	*Chromadora macrolaimoides*	42.5	12/12	26.7	6/8	4.6	6/7	–	–	18.0	3/4	2-A
2	*Monhystera* spp. group	17.1	9/12	5.8	8/8	*	3/7	8.3	3/3	7.8	4/4	1-B
3	*Hypodontolaimus pilosus* n. sp.	9.8	4/12	–	–	–	–	–	–	2.9	1/4	2-A
4	*Chromadorina epidemos* n. sp.	8.1	4/12	3.5	5/8	48.3	7/7	–	–	21.5	3/4	2-A
5	*Syringolaimus striatocaudatus*	7.5	7/12	25.9	7/8	5.8	6/7	6.8	2/3	9.1	4/4	2-A
6	*Euchromadora gaulica*	3.6	10/12	2.3	2/8	*	4/7	*	1/3	1.8	4/4	2-A
7	*Oncholaimus dujardinii*	2.1	6/12	3.3	1/8	2.1	4/7	–	–	1.9	3/4	2-B
8	*Paracanthonchus platypus*	*	2/12	*	1/8	2.1	6/7	1.2	2/3	1.3	4/4	2-A
9	*Eurystomina minutisculae*	*	2/12	1.7	4/8	–	–	1.8	1/3	*	3/4	2-B
10	*Chromadora nudicapitata*	*	1/12	–	–	*	2/7	10.2	2/3	2.1	3/4	2-A
11	*Prochromadorella* spp. group	*	1/12	2.9	3/8	1.6	6/7	5.0	2/3	2.0	4/4	2-A
12	*Atrochromadora denticulata*	*	2/12	3.1	4/8	*	1/7	–	–	*	3/4	2-A
13	*Spilophorella paradoxa*	*	1/12	5.2	4/8	5.8	6/7	24.0	3/3	7.3	4/4	2-A
14	*Araeolaimus texianus*	*	1/12	2.5	1/8	*	2/7	*	2/3	*	4/4	1-A
15	*Viscosia macramphida*	–	–	1.0	2/8	1.1	5/7	4.0	2/3	1.3	3/4	2-B
16	*Enoplus* sp.	*	1/12	–	–	–	–	–	–	*	1/4	2-B
17	*Calyptronema denticulatum*	–	–	*	2/8	*	2/7	–	–	*	2/4	2-B
18	*Microlaimus cyatholaimoides*	–	–	*	1/8	–	–	*	1/3	*	2/4	2-A
19	*Theristus fistulatus*	–	–	*	1/8	*	3/7	–	–	*	2/4	1-B
20	*Metoncholaimus scissus*	–	–	–	–	1.3	5/7	–	–	*	1/4	2-B

* < 1 per cent.

TABLE 2 (CONTINUED)

No.		Individual sites								Total of 4 sites		
		A		B		C		D				
		Percentage abundance	Frequency	Percentage abundance	Frequency	Percentage abundance	Frequency	Percentage abundance	Frequency	Percentage abundance	Frequency	Feeding type
21	*Spirinia parasitifera*	–	–	–	–	*	2/7	–	–	*	1/4	2-A
22	*Euchromadora meadi*	–	–	–	–	*	1/7	–	–	*	1/4	2-A
23	*Chromadorina germanica*	–	–	–	–	–	–	10.3	2/3	1.9	1/4	2-A
24	*Phanoderma* sp.	–	–	–	–	–	–	*	1/3	*	1/4	2-A
25	Desmodorid	–	–	*	1/8	–	–	–	–	*	1/4	2-A
26	Oncholaimid	–	–	–	–	–	–	*	1/3	*	1/4	2-B
27	Oxystominid	–	–	–	–	–	–	*	1/3	*	1/4	1-A
28	Epsilonematid	–	–	–	–	–	–	1.5	2/3	*	1/4	1-A
29	Unidentified	7.1		15.4		22.6		24.2		17.2		
	Total No. Specimens Examined	1100		483		1420		678		3681		
	Average No. Specimens/Sample	92		60		203		226		120		

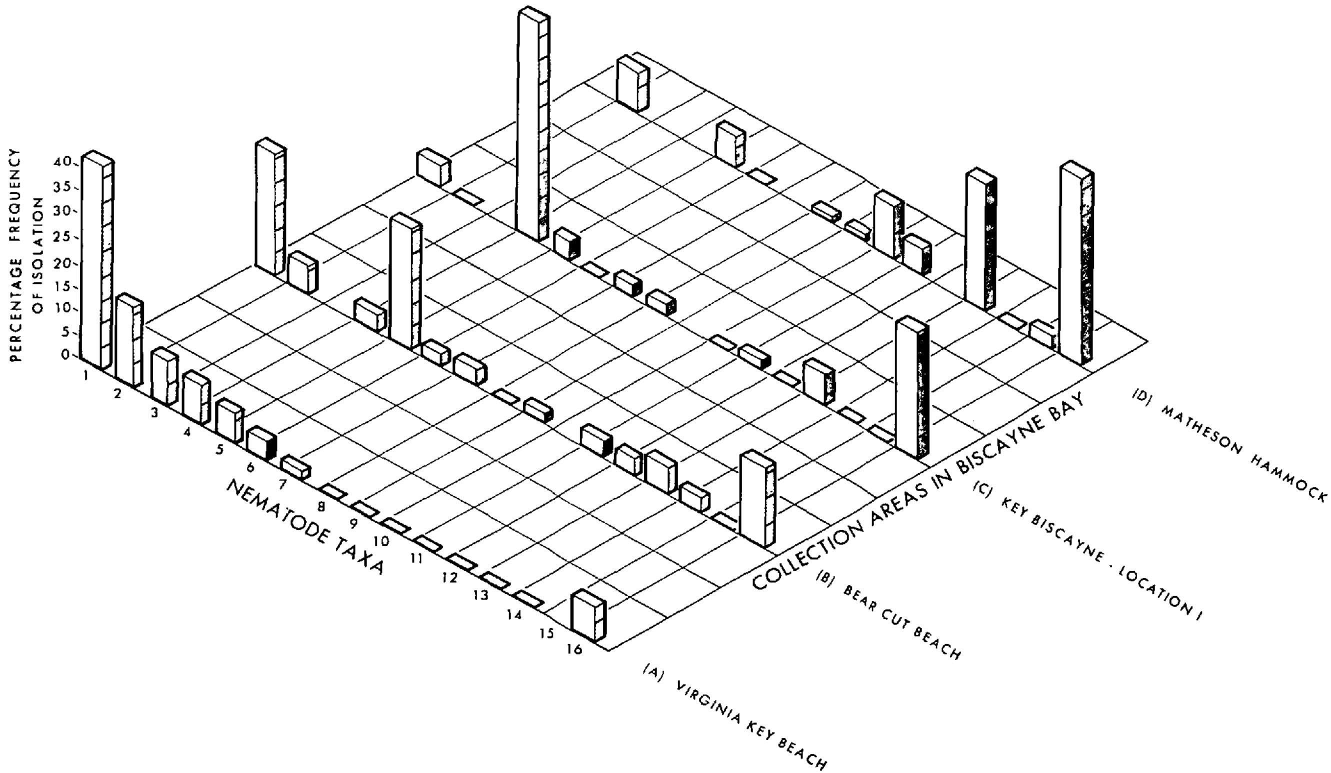


FIGURE 2. Diagrammatic representation of percentage frequency of isolation of nematode taxa at the four collection sites.

animals that were infrequently isolated or were unidentified juveniles. Upon subsequent examination and identification, certain of the latter have been recognized as previously documented taxa. For instance, six of the 7.1 per cent of the unidentified specimens at Site A (Table 2) have been found to be juvenile chromadorids. This additional six per cent of the nematodes at Site A increases the size of feeding group 2-A. These small, nevertheless important, corrections have been considered in the presentation of our data. The *Monhystera* spp. group (No. 2) comprises four species of which *M. parva* is the most abundant, occurring at all test sites. Similarly, the *Prochromadorella* spp. group (No. 11) is represented by two species, which are found in different areas; *P. neapolitana* in Sites A to C and *P. micoletzkyi* at Site D.

Certain noteworthy trends in species distribution may be seen from the data presented in Table 2 and Fig. 2. These are summarized below:

a) *Chromadora macrolaimoides* (No. 1) decreases significantly from A to D, being absent at the latter site.
b) *Monhystera* spp. group (No. 2) is most common at A, decreasing to < 1 per cent at C.
c) *Hypodontolaimus pilosus* (No. 3) is found only at A.
d) *Chromadorina epidemos* (No. 4) occurs in low concentrations at A and B, is very abundant at C, but is absent from D.
e) *Syringolaimus striatocaudatus* (No. 5) is three times as common (*ca.* 26 per cent) at B as at the other sites.
f) *Euchromadora gaulica* (No. 6) is in low concentrations at all sites, with a gradual decrease in numbers from A to D.
g) *Oncholaimus dujardinii* (No. 7) is in low concentrations at A, B, and C, but is absent from D.

Incidence of occurrence of the dominant species, especially between Sites A and D, may be indicative of physiographic differences between sites. The high percentage abundance of *Spilophorella paradoxa* at D compared with its near absence at A is discussed below.

The *Monhystera* spp. group (No. 2) exhibits a physiographic distributional gradient of A, B, D, and C. As noted in Table 2 and Fig. 2, distribution of *Monhystera*, predominantly *M. parva*, shows a trend from Site A (17 per cent) to Sites B and D (5.8 and 8.3 per cent, respectively) and Site C (0.9 per cent). Certain species of *Monhystera* have been considered (Wieser, 1959) to have an affinity to exposed sites in comparison with the remainder of the Monhysteridae whose frequency may be used to indicate the abundance of sediment within a particular biotope.

The significant abundance of *C. epidemos* (No. 4) at C suggests that this species may be more common within protective habitats in view of the difference of over 40 per cent between its occurrence at C and the

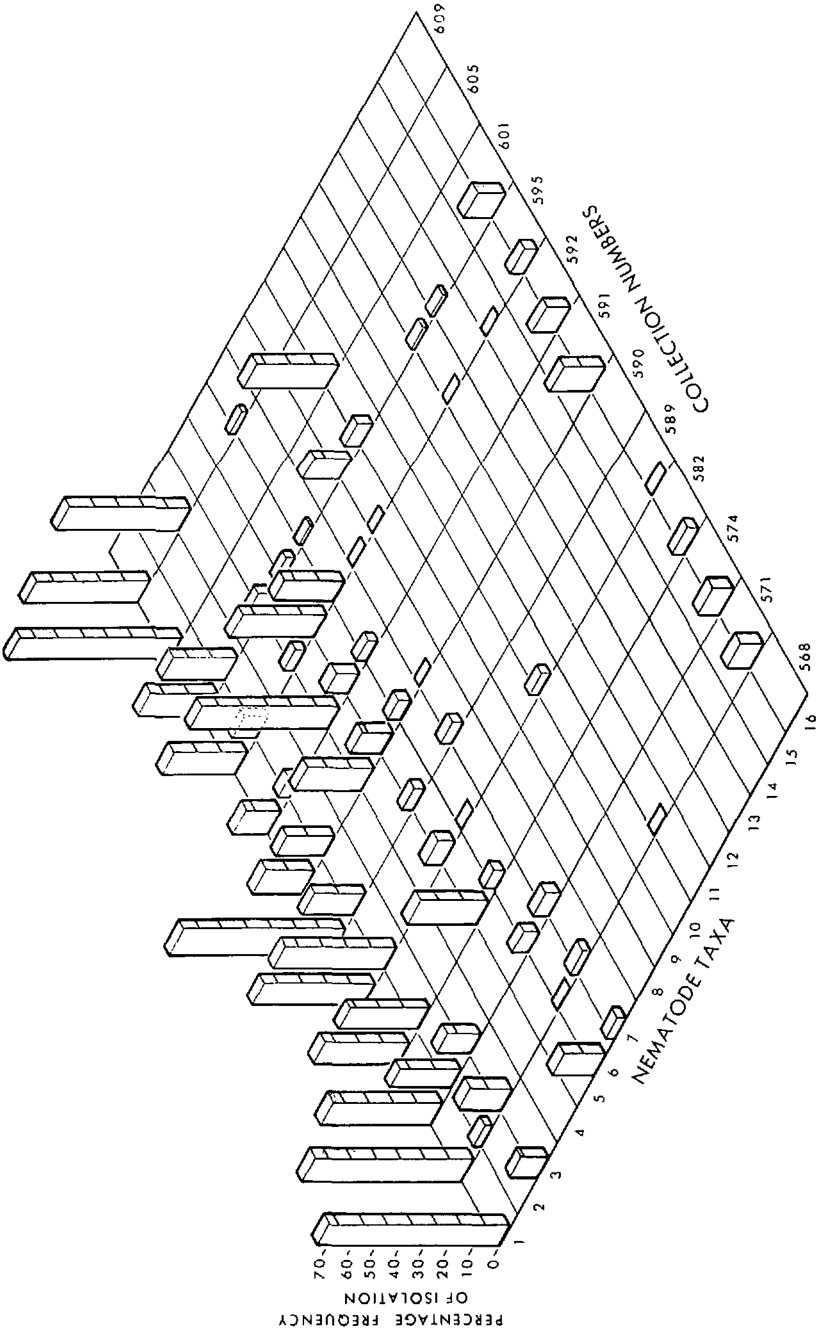


FIGURE 3. Comparison between various collections and percentage frequency of isolation of nematode taxa at Site A.

other three sites. As noted earlier, C differs in various hydrographic aspects from A, B, and D.

The inverse relationship of *C. macrolaimoides* and *S. paradoxa* in the site series A-D is of particular interest in view of the physiographic gradient of A, B, D, and C noted above for the *Monhystera*. Possibly, the distance between D and the other sites may have a greater influence on the faunal composition than has the degree of exposure and sediment abundance. However, it has been observed elsewhere (Wieser, 1959) that widely separated areas have a characteristic pattern in distribution of certain species. Wieser found *Chromadorina laeta* to be the dominant species in algae subjected to extreme exposure on the coasts of Chile, the Mediterranean Sea, and the North Sea. Our data support the observations on the dominance of the composite chromadorid group in algal environments, for this group accounted for nearly 60 per cent of the total nematode population in the present study. At A, the area most extensively examined, the chromadorids represented 72 per cent of the nematode biota. Lower concentrations of this group at other sites (51 per cent at D) may be attributed to the relatively large number of unidentified specimens.

Red algae were the dominant epiphytes, especially species of *Gracilaria*, *Ceramium*, *Spyridia*, and *Acanthophora*. *Lithothamnium* also was present in large concentrations. At this time, it is not possible to make direct correlations between amount of red algal growth and numbers of nematodes. Collection No. 601 at A showed tremendous algal development on the leaves with, however, correspondingly few nematodes present. Considerable variability in nematode colonization is apparent in that certain blades of single collections are heavily colonized while others, often with the same type and amount of epiphytic growth present, have only few animals present. One sample (No. 596) from Matheson Hammock was especially noteworthy in that approximately 5,000 nematodes, predominantly chromadorids, were tabulated on the ten leaves examined. It is of interest that the green algal epiphytes present on the leaves of sample No. 596 showed a state of decline or senescence. The shallow warm water, combined with the effect of accelerated light penetration, apparently was deleterious to optimal development of the algae and *Thalassia* plant. Preliminary evidence suggests that the state or condition of the epiphyte has a greater effect on nematode colonization than does the specificity of the alga itself. Further work along these lines is in progress.

Percentage frequency and relative abundance of the nematode taxa of the samples from A are diagrammed in Fig. 3. Only five of the 14 taxa specifically considered at this site occur in 50 per cent or more of the samples. Of these, the most striking is *C. macrolaimoides* (No. 1) which was found in every sample with a relative abundance greater than 20 per cent. The few specimens, *i.e.*, 3, in sample No. 605, precludes analysis of the data from this collection. Whether the small number of nematodes is an expression of a population trend or merely represents habitat variability is not known.

Most samples were represented by comparatively few taxa which comprised the major nematode biota of that particular collection. *S. paradoxa* and *A. texianus* (No. 14) probably are not normal inhabitants of A since only one specimen of each species was isolated from the total of 1,100 animals examined from this site.

Seasonal distribution patterns are evident to some extent, based on the data presented in Fig. 3 and supplemented with information derived from samples collected at Sites B and C. The data suggest the nematode population to be largest during the period October-March. The average number of specimens obtained from samples collected within this period was 185 as compared to 53 for April-September.

C. macrolaimoides is the dominant species encountered during the colder portions of the year. The appearance of other species in the warm periods (*Monhystera* spp., *C. epidemos*, *S. striatocaudatus*) depresses the relative dominance of *C. macrolaimoides*. *Monhystera* spp. appears to do well only in the warmer portion of the year while the reverse may hold for *Hypodontolaimus pilosus*. The latter species was restricted to collections made in the period November-February. *C. epidemos* is limited to the summer season at Site A, but occurs in high numbers in October-December at C. This perhaps suggests a seasonal response to sedimentation at Site A which may be lacking at other times. Similarly *S. striatocaudatus* appears to be limited to A during the warmer months but is present at the others at different times.

We have used a trellis diagram for comparative presentation of the collection data (Fig. 4). This procedure, originally used for delineation of terrestrial animal communities, is a semi-quantitative expression of the percentage commonness, or relationship, of the fauna between pairs of samples. In recent years, this method has been used in marine biology (Wieser, 1960; Sanders, 1960; King, 1962) for expression of ecological data. Similarity of animal communities can be obtained by an analysis and comparison of samples collected within and between various sites. Homogeneity, or affinity, is indicated by a high percentage of commonness while conversely, heterogeneity, or diversity, is expressed by a low figure. A more complete discussion of the method is given by Wieser (1960) and Sanders (1960).

Several significant trends are noted in the averages derived from the trellis diagram (Table 3). Uniformity is apparent *within* sites, especially at C (63 per cent). The index of faunal affinity within sites is greater than that between sites. The range of averages within sites is 45-63 per cent while that between sites is 17-40 per cent. Thus, while distribution of the feeding types shows similarity, affinities between sites suggest a dissimilarity in the species of a group with essentially comparable feeding habits. When A is compared with the other sites, it is seen that a trend exists from A to D comparable to that observed between *C. macrolaimoides* and *S. paradoxa*, *i.e.*, a uniform decrease in the index of affinity from 48 to 17 per cent. Site B has about as much in common with the other areas as it has within itself, while C and D show the greatest homogeneity within sites and have the least in common with the other sites. The data for C support our earlier observations that this site is indeed unique of the locales studied. The index of affinity within C is 63 per cent while that between the sites is grouped between 24-33 per cent. Here again the data is conflicting in that it supports both the A to D gradient series as well as the A, B, D, and C series. These variabilities may be due in part to the peculiar characteristics of C and D, *i.e.*, heavy fine sedimentary layer with subsurface anaerobic strata at C and extremely shallow water with mangrove runoff at D.

Considerable attention has been given in the literature to separation of nematode groups into four general feeding types based on stomatal morphology. These groupings, proposed by Wieser (1953) are:

Group Designation	*Characteristics*
1-A	Without oral cavity (selective deposit feeders)
1-B	With a large "unarmed" oral cavity (non-selective deposit feeders)
2-A	With relatively weak oral armament (epistratum feeders)
2-B	With heavy oral armament (predators and omnivors)

Among the exceptions to the above system have been the observations that oncholaimids, while possessing heavy oral armament, nevertheless, feed in the manner of non-selective deposit feeders (Perkins, 1958; Wieser, 1962; Hopper & Meyers, 1966). King (1962) has suggested that these questionable feeding types possess latent ability to function as true predators, and thus may be retained in feeding group 2-B. Based on the observations of Timm (1951), *i.e.*, presence of green algae in the gut and nature of the intestinal cell inclusions of *Syringolaimus smargidus* (now regarded a synonym of *S. striatocaudatus*), this animal may be considered as an epigrowth feeder (2-A) rather than a predator. In view of the large concentration of *Syringolaimus* in our samples, correct interpretation of the feeding characteristics of this animal will affect materially the analysis of composition of the distribution of the feeding types within the various sites.

The averages of the feeding types noted in our study are compared in Table 4 with those found earlier by Wieser (1953). In spite of the rather large number of unclassified specimens, feeding type 2-A comprises from

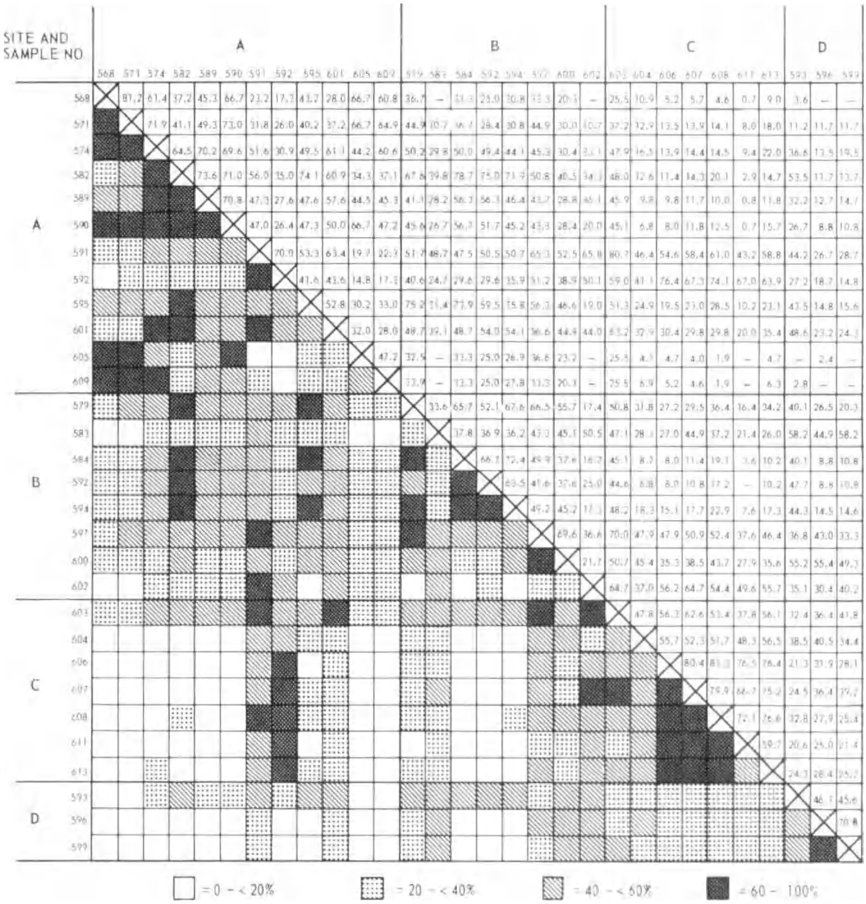


FIGURE 4. Trellis diagram showing affinities of nematode fauna between various sites.

58 to 85 per cent of the total nematode fauna. Since the majority of these unclassified animals are chromadorid juveniles, inclusion of these data into the final compilation would increase the proportion and final average of group 2-A in Sites B, C, and D. However, at this time we prefer to consider the unclassified specimens tentatively as a fifth group. Although the average percentage distribution of group 1-B approximates that found by Wieser on exposed algae, none of the four sites currently examined may be considered as truly exposed locales such as those of rocky shores subject to wave and wind action.

TABLE 3
AVERAGE FAUNAL INDEX OF AFFINITY WITHIN AND BETWEEN COLLECTION SITES*

Sites	Sites			
	A	B	C	D
A	48.1	39.3	23.9	17.4
B	39.3	45.0	32.5	34.5
C	23.9	32.5	63.0	30.3
D	17.4	34.5	30.3	54.2

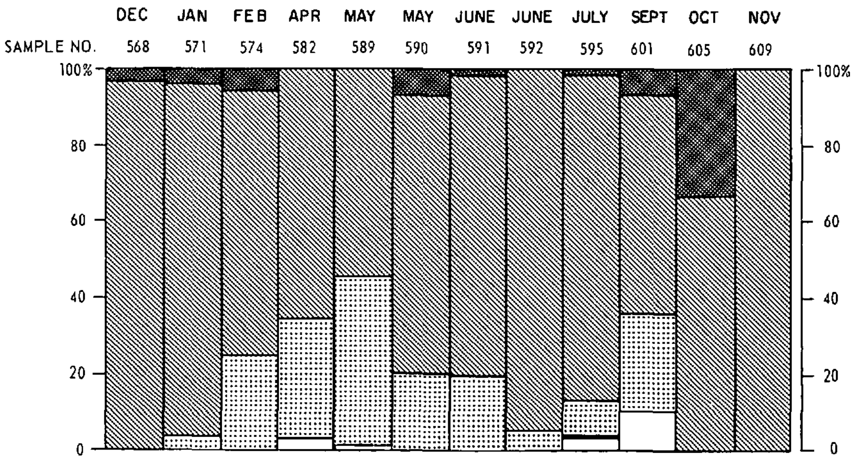
* Based on data from trellis diagram from Figure 2.

Characterization of the samples of A based on feeding type is given in Fig. 5. It appears that the percentages of animals of the 2-A group decrease during the spring with an increase in those of group 1-B. It is of interest to note that at this site *Monhystera* spp. are the sole constituents of the latter group. Representatives of the omnivorous (predacious) group 2-B are in low concentrations throughout the year, while members of group 1-A are practically absent from this particular locale.

The uniformity extant within and between the four sites is evidenced by the high percentage of nematodes of feeding type 2-A (Table 4). These data support earlier observations (Wieser, 1959) on the predominance of one nematode species type as characteristic of algal nematode populations. The distribution of group 1-B is in reverse relationship to sediment concentration since C had maximal detrital deposition on the leaves. The majority of the nematodes of this group were species of *Monhystera*, common in locales characterized by a relatively high degree of exposure (Wieser, 1959). As noted, the Virginia Beach locality (Site A) has a moderate amount of wave action and wind turbulence.

Subsequent investigations of the surface sediments at the various sites revealed species of nematodes different in number and type from those on the nearby *Thalassia* leaves. Only at C was there an appreciable overlap of foliicolous and benthic taxa. Here *Theristus fistulatus* (No. 19), *Metoncholaimus scissus* (No. 20), *Spirinia parasitifera* (No. 21), and *Euchromadora meadi* (No. 22) comprised 2.5 per cent of the foliicolous fauna. Of these, the first three taxa represent three of the four dominant benthic species (Hopper & Meyers, MSS), comprising nearly 90 per cent of the benthic nematode population. Possibly, the heavy deposition of sediment on the leaves of *Thalassia* at C allows colonization by various of the benthic fauna.

Thorson (1957) and Wieser (1959) have proposed principles regarding replacement of one taxon by a closely related form. Thorson, commenting on bottom communities, has suggested "the same type of bottoms



	DEC	JAN	FEB	APR	MAY	MAY	JUNE	JUNE	JULY	SEPT	OCT	NOV
SAMPLE NO.	568	571	574	582	589	590	591	592	595	601	605	609
2B	2.7	3.4	5.4	0	0	6.7	0.9	0.0	0.9	6.0	33	0
2A	97.3	93.2	70.2	65.7	54.7	73.3	79.5	95.1	86.2	58.0	67	100
1B	0	3.4	24.4	31.4	44.5	20.0	19.6	4.9	9.5	26.0	0	0
1A	0	0	0	0	0	0	0	0	0.9	0	0	0
UNCLASSED	0	0	0	2.9	0.8	0	0	0	2.6	10.0	0	0
NO. SPECIMENS	37	204	242	35	128	15	117	81	116	50	3	72

FIGURE 5. Distribution of the various feeding types at Site A.

are everywhere inhabitated by species of parallel animal communities, in which different species of the same genera replace one another as 'characterizing species.' " Wieser proposes a similar principle, that of alternate species ("*Alternanz*" Ger.), in which closely related species replace one another in areas subjected to divergent environmental pressures. Support for these theories is found in our data in the occurrence of separated populations of species pairs belonging to the genera *Chromadora*, *Chromadorina*, and *Prochromadorella*, wherein one member of the pair occurs in the area of Sites A-C and the other at Site D. However, since our habitats are physiographically different from each other, Thorson's principle may not be operative. We regard Wieser's principle of alternate species as a more suitable hypothesis to explain the distributional patterns observed.

TAXONOMIC SECTION

In this section are presented descriptions of the species of nematodes identified. Previously recorded species are discussed briefly with reference made to more extensive accounts elsewhere of figures and discussions: (*Note*) A taxonomic treatment of the sedimentary nematode fauna of Florida has been prepared recently by Wieser & Hopper (1967). Those

TABLE 4

PERCENTAGE DISTRIBUTION OF NEMATODE FEEDING TYPES FROM BISCAYNE BAY, FLORIDA, COMPARED WITH OTHER COLLECTIONS*

Feeding type or group	Biscayne Bay collections				Avg. of 4 sites	Other studies†	
	Site A	Site B	Site C	Site D		Algae exposed	Algae sheltered
2-B	2.6	6.4	4.9	6.0	5.0	26.3	10.0
2-A	85.1	70.2	70.1	58.1	70.9	59.8	47.5
1-B	17.1	6.0	1.4	8.3	7.7	5.6	37.2
1-A	0.1	2.5	0.4	2.3	1.3	7.7	5.3
Unclassed	1.1	15.4	22.6	23.6	15.7	0	0

* Numbers indicate percentage of nematodes present.
† Based on literature compilation (Weiser, 1953).

species recorded from Florida for the first time here are described in detail with appropriate illustrations.

An artificial key to the most commonly encountered species has been prepared to facilitate identification of the foliicolous nematode population. As our knowledge of the nematode fauna of this habitat increases, the key will be modified as necessary. Eventually a key will be prepared to include the majority of the nematode species of algal environments of the West Indies and the east coast of North America.

Nematological terminology, methodology, and morphological and taxonomical aspects can be obtained in the summary papers of Chitwood (1951) and Chitwood & Timm (1954), dealing with the North American and the Gulf of Mexico marine nematodes, respectively.

KEY TO SPECIES OF NEMATODES FROM LEAVES OF *Thalassia testudinum* KÖNIG

1. Cuticle ornamented with various punctations.................. 2
   Cuticle plain, perhaps striated, but never with punctations........ 14
2. Cuticular punctations on lateral surface arranged in longitudinal rows.................. 3
   Cuticular punctations unaltered on lateral surface.................. 8
3. Lateral punctations arranged in four longitudinal rows.................. 4
   Lateral punctations arranged in two longitudinal rows.................. 5
4. Male with two small, cup-shaped preanal supplements.................. ....*Chromadora macrolaimoides* Steiner
   Male with four cup-shaped preanal supplements, the first very small and located 5 μ in front of anus.................. ....*Chromadora nudicapitata* Bastian

5. Stoma with 3 small solid teeth 6
Stoma with 1 large tooth (solid or hollow) 7
6. Male with 5 cup-shaped preanal supplements, esophagus with elongate terminal swelling .... *Chromadorella filiformis* (Bastian)
Male without supplements, esophagus with terminal bulb .... *Atrochromadora denticulata* Wieser & Hopper
7. Tooth solid, esophagus with double terminal bulb, body without conspicuous setae .... *Spilophorella paradoxa* (de Man)
Tooth hollow, esophagus with single terminal bulb, body with prominent setae .... *Hypodontolaimus pilosus* n. sp.
8. Esophagus with terminal bulb 9
Esophagus with elongate terminal swelling 10
9. Male with 14-16 cup-shaped preanal supplements .... *Chromadorina germanica* (Bütschli)
Male without cup-shaped preanal supplements .... *Chromadorina epidemos* n. sp.
10. Amphid spiral, preanal supplements tuboid .... *Paracanthonchus platypus* Wieser & Hopper
Amphid obscure, preanal supplements either cup-shaped or lacking 11
11. Male without supplements, gubernaculum with lateral pieces 12
Male with 5 cup-shaped supplements, gubernaculum without lateral pieces 13
12. Distal extremity of gubernaculum with posteriorly directed hook; lateral pieces of gubernaculum L-shaped .... *Euchromadora meadi* Wieser & Hopper
Gubernaculum without distal hook, lateral pieces with only a slight hook .... *Euchromadora gaulica* Inglis
13. Spicules 30 μ long, extending up to, but not beyond the posteriormost preanal supplement .... *Prochromadorella neapolitana* (de Man)
Spicules 45 μ long, always extending past the posteriormost preanal supplements .... *Prochromadorella micoletzkyi* Chitwood
14. Esophagus with terminal bulb or swelling 15
Esophagus without terminal bulb 18
15. Ocelli present .... *Araeolaimus texianus* Chitwood
Ocelli absent 16
16. Amphid small, obscure, located on lips; stoma long, tuboid, anteriorly armed with 3 small teeth .... *Syringolaimus striatocaudatus* de Man
Amphid circular (or cryptospiral), prominent, located postlabially;

stoma small, inconspicuous; teeth, if observed, minute and located in mid-stoma 17

17. Amphid located anteriorly, at level of cephalic setae, body length 1.5 mm .... *Spirinia parasitifera* (Bastian)
Amphid located posterior to cephalic setae, body length 0.6-0.7 mm .... *Microlaimus cyatholaimoides* de Man

18. Stoma small, often inconspicuous, without teeth 19
Stoma well developed, spacious; armed with prominent teeth 23

19. Cuticle with transverse striations .... *Theristus fistulatus* Wieser & Hopper
Cuticle without transverse striations 20

20. Tail elongate (over 25% of total length of nema), gradually tapering to an elongate spinneret tube .... *Monhystera parelegantula* De Coninck
Tail shorter, cylindro-conoid, with rounded terminus, spinneret tube very short 21

21. Ocelli present (at level of amphids) .... *M. ocellidecoris* n. sp.
Ocelli absent 22

22. Cephalic setae (only 6?) very short, about 1 μ long, amphid about 1.5 head diameters from anterior end, anterior cervical setae short .... *M. dubicola* n. sp.
Cephalic setae (10) 3 + 2 μ long, amphid about 1 head diameter from anterior end, anterior cervical setae about 3 μ long .... *M. parva* Bastian

23. Buccal cavity with 3 prominent teeth 24
Buccal cavity apparently with one tooth, ocelli present 27

24. Buccal cavity with two large teeth and one small tooth .... *Pontonema problematicum* Chitwood
Buccal cavity with one large tooth and two smaller teeth 25

25. Body length more than 4 mm, spicules 175-180 μ long; female with demanian system .... *Metoncholaimus scissus* Wieser & Hopper
Body length less than 3 mm, spicules 23-27 μ long; female without demanian system 26

26. Tail 155-195 μ long (8-11 anal body diameters) .... *Viscosia macramphida* Chitwood
Tail 65-70 μ long (about 2.5 anal body diameters) .... *Oncholaimus dujardinii* de Man

27. Ocelli at base of buccal cavity, lumen of esophagus dilated anteriorly .... *Calyptronema denticulatum* (Micoletzky)
Ocelli posterior to buccal cavity, lumen of esophagus not dilated anteriorly .... *Eurystomina minutisculae* Chitwood

Descriptions

Oncholaimus dujardinii de Man, 1876

Note.—See Wieser & Hopper (1967).

Cuticle smooth, without striations or punctations. Maximum width 48-50 μ. Head 18-20 μ wide, with ten short cephalic setae, 4 + 3 μ in length. Stoma 25 μ long, armed with three teeth, of which the left subventral tooth is the largest, the dorsal the smallest. The right subventral tooth seems intermediate in size. Esophagus 360-410 μ long, cylindroid-conoid. Excretory pore 50-57 μ from anterior extremity.

Male 2.68 mm long; *a*, 56; *b*, 7.4; *c*, 61. Spicules 30 μ long, nearly straight. Gubernaculum absent. Tail 44 μ long.

Female 3.0 mm long; *a*, 60; *b*, 7.3; *c*, 46; *V*, 75 per cent; monodelphic, prodelphic, ovary reflexed. Eggs 100-105 μ long by 38-42 μ wide; wide eggs in uterus at one time. Tail 66 μ long (2.4 anal body diameters). Anal body diameter 27 μ.

Habitat.—Sites A, B, and C.

Geographical distribution.—Cosmopolitan.

Metoncholaimus scissus Wieser & Hopper, 1967

Synonyms.—*Metoncholaimus* sp. (Hopper & Meyers, 1966; Meyers & Hopper, 1966).

Note.—See Wieser & Hopper (1967).

Cuticle smooth, without striations or punctations. Maximum width 60-80 μ. Head 36-40 μ wide, with six labial papillae and ten cephalic setae, 15 + 13 μ in length. Stoma 45-48 μ long by 25-27 μ wide, armed with three teeth, the left subventral being considerably larger than the others. Esophagus 600-640 μ long, cylindroid-conoid. Excretory pore 105-125 μ from anterior extremity.

Male 3.98-4.70 mm long; *a*, 62-73; *b*, 6.7-7.0; *c*, 19-25. Spicules 163-190 μ long. Gubernaculum absent. Tail 180-230 μ long, typically in shape of shepherd's crook, with 5 pairs of circumanal setae, 6-7 pairs of subventral setae and two ventral, subterminal fleshy papillae. A non-sclerotized, pore-like supplement occurs immediately preanal.

Female 4.35-5.25 mm long; *a*, 56-60; *b*, 7.1; *c*, 22-25; *V*, 65-72 per cent; monodelphic, prodelphic, ovary reflexed. Egg size variable, dependent upon number in uterus, 52 eggs observed in one specimen (Hopper & Meyers, 1966). Demanian system present; exit pores transversely slit-like, 165-185 μ preanal; moniliform glands 185-240 μ long. Tail 175-200 μ long.

Habitat.—Site C.

Geographical distribution.—Biscayne Bay, Florida (Wieser & Hopper, 1967). The species also has been seen in samples collected at Pigeon Key, Florida, 40 miles north of Key West.

Viscosia macramphida Chitwood, 1951

Note.—See Chitwood (1951) and Wieser & Hopper (1967).

Cuticle smooth, without striations or punctations. Maximum width 37-47 μ. Head 12-16 μ wide. Stoma 17-22 μ long, armed with three elongated teeth. Esophagus 257-312 μ long, cylindroid-conoid. Excretory pore 160-193 μ from anterior extremity. Tails similar in both sexes, 170-240 μ long (8.3-11 anal body diameters). Anal body diameter 20-23 μ.

Male 1.65-1.96 mm long; *a*, 42-47; *b*, 6.3-6.4; *c*, 8.2-9.7. Spicules 25-26 μ long, nearly straight. Gubernaculum absent.

Female 1.65 mm long; *a*, 36; *b*, 6.3; *c*, 8.7; *V*, 47 per cent; didelphic, amphidelphic, ovaries reflexed. The intestine passes to the right of both gonads.

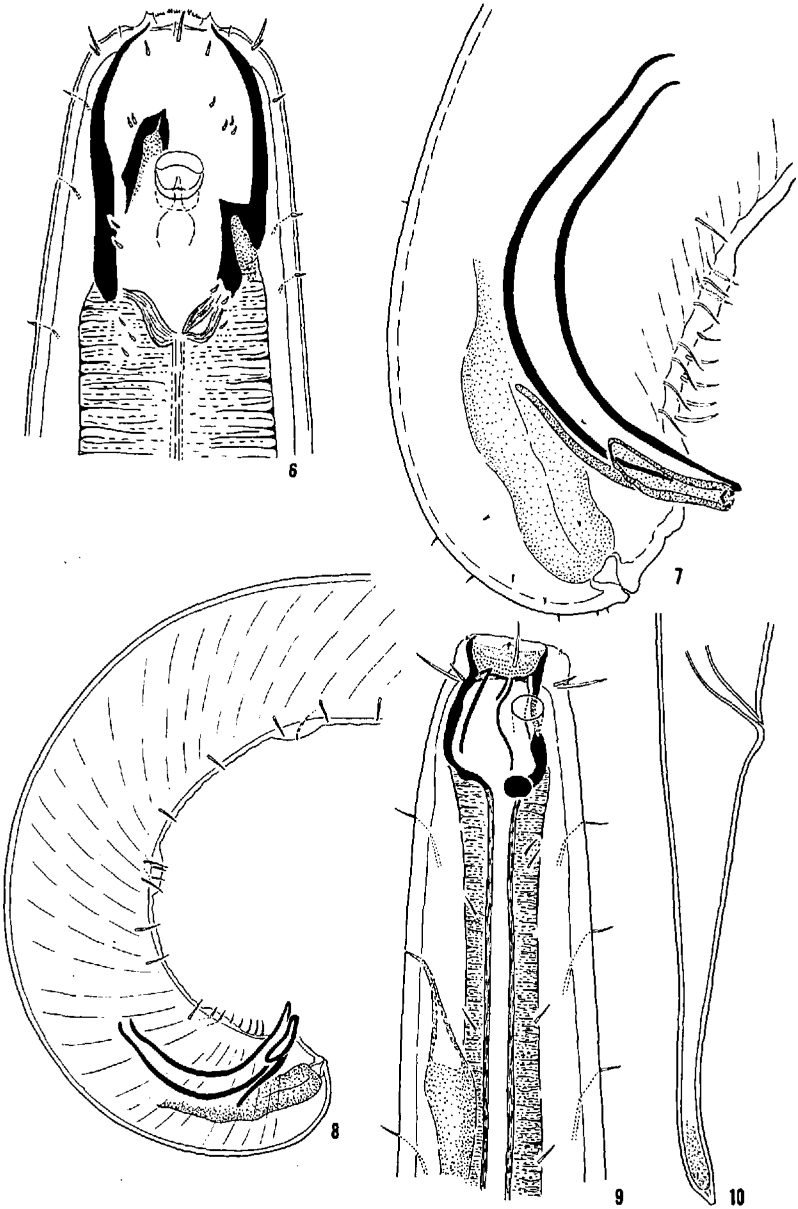
Habitat.—Sites B, C, and D.

Geographical distribution.—Aransas Bay, Texas (Chitwood, 1951); Biscayne Bay, Florida (Wieser & Hopper, 1967).

Pontonema problematicum Chitwood, 1960
Figs. 6-8

Cuticle smooth, without striations or punctations. Maximum width 110-154 μ. Head 60-70 μ wide, with six small labial papillae and ten cephalic setae, 10 + 5 μ in length. One or two 5 μ long subcephalic setae are located just posterior to each lateral cephalic seta. Numerous other setae are present arranged as illustrated (Fig. 6). Amphid 14-18 μ wide in male, 8 μ wide in female, with clear area at its base. Stoma 100-120 μ long by 53-60 μ wide, armed with three teeth. Subventral teeth, large and of equal size, located at 30 per cent of stoma, dorsal tooth smaller, located at 60 per cent of stoma. Esophagus 1.0-1.27 mm long, cylindroid. Excretory pore 320 μ from anterior extremity. Tails similar in both sexes, 45-70 μ long (less than one anal body diameter). Anal body diameter, 82-90 μ.

Male 7.4-7.5 mm long; *a*, 52-68; *b*, 6.6-7.5; *c*, 150-166; testes opposed, outstretched. Spicules 175-180 μ long (chord 130-135 μ). Gubernaculum 77 μ long, with prominent lateral flanges. Three pairs of subventral preanal cuticular elevations present, the anteriormost with one short seta, the second with two setae, and the third with two-three setae. Two subventral rows of 14 μ long setae are present in the preanal region. Four short ventral-subventral rows of setae of variable length are located between the



FIGURES 6-10. 6, *Pontonema problematicum*, anterior end of male; 7, same, spicular apparatus and setation; 8, same, posterior end of male.—9, *Calyptronema denticulatum*, anterior end of female; 10, same, posterior end of female.

anal opening and the posteriormost preanal cuticular elevation.

Female 7.8-8.3 mm long; *a*, 52-54; *b*, 6.5-6.6; *c*, 119-143; *V*, 58-72 per cent; didelphic, amphidelphic, ovaries reflexed. Eggs (one per uterus) 197-212 μ long by 102-105 μ wide.

Habitat.—Sites C and D.

Geographical distribution.—Dillon Beach, California (Chitwood, 1960).

Remarks.—Chitwood records the presence of purple pigment "Immediately behind the amphids" in live specimens of *Pontonema problematicum*, which became yellow-brown in glycerin-preserved material. The clear area immediately behind the amphids in our specimens, may have originally been colored, but, this may have been removed by preservation in formaldehyde and dehydration in a methanol-glycerin solution. In various other species, these areas are known to fade upon preservation. Thus, we do not feel justified in establishing a new species on the presence or absence of pigmented areas.

Eurystomina minutisculae Chitwood, 1951

Note.—See Chitwood (1951); Timm (1952); Wieser & Hopper (1967).

Cuticle smooth, without striations or punctations. Maximum width 45 μ. Head 15-20 μ wide, with six labial papillae and ten cephalic setae 9 + 5 μ in length. Stoma 15-18 μ long, divided into two chambers by two-three rows of denticles and armed with a single, broad-based subventral tooth. Ocelli 55-58 μ from anterior extremity. Esophagus 660-670 μ long, cylindroid-conoid. Excretory pore located anteriorly, at level of mid-stoma.

Male 3.57 mm long; *a*, 79; *b*, 5.4; *c*, 31. Spicules 58 μ long (chord 45 μ). Apophysis of gubernaculum 25 μ long. Two typical "winged" preanal supplements present.

Habitat.—Sites A, B, and D.

Geographical distribution.—Aransas Bay, Texas (Chitwood, 1951), Chesapeake Bay, Maryland (Timm, 1952), San Salvador (Gerlach, 1955: *E.* aff. *minutisculae*), and Biscayne Bay, Florida (Wieser & Hopper, 1967).

Calyptronema denticulatum (Micoletzky, 1930) Wieser, 1953
Figs. 9, 10

Synonyms.—*Enchelidium pauli* var. *denticulatum* Micoletzky, 1930; *Enchelidium denticulatum* (Micoletzky, 1930) Sch.-Stekhoven, 1950.

Cuticle smooth, without striations or punctations. Maximum width, 100-130 μ. Head 21-23 μ wide, with six labial papillae and ten cephalic setae, 9 + 4 μ in length. Cervical and somatic setae present. Hypodermal glands present in lateral chords. Amphids 5 μ wide, slightly transversely oval.

Stoma 25-30 μ long, divided into a smaller, finely denticulated, anterior chamber and a larger, expanded, posterior chamber; armed with a single, narrow, subventral tooth. Esophageal gland orifices at base of anterior chamber. Ocelli 25 μ from anterior extremity (at base of stoma). Excretory pore 53 μ from anterior extremity; terminal excretory duct 16 μ long. Esophagus 930-965 μ long, cylindroid; anterior portion of esophageal lumen dilated. Nerve ring at 33 per cent of esophageal length from anterior extremity.

Female 4.44-5.23 mm long; *a*, 40-44; *b*, 4.8-5.4; *c*, 24.7-26.5; *V*, 54-56 per cent; didelphic, amphidelphic, ovaries reflexed. Tail 180-197 μ long (4.5 anal body diameters), conical, posterior third cylindrical, terminus slightly swollen. Anal body diameter, 40-44 μ.

Habitat.—Sites B and C.

Geographical distribution.—Sunda Islands (Micoletzky, 1930).

Paracanthonchus platypus Wieser & Hopper (1966).

Note.—The following is a condensation of the original description by Wieser & Hopper (1967).

Body 1.18-1.32 mm long. Cuticle with transverse rows of punctations. Maximum width, 44-48 μ. Head 21-23 μ wide, with six labial papillae and ten cephalic setae, 5 + 4 μ in length. Stoma shallow, armed with a medium-sized triangular tooth. Amphids, spirals of 3-1/2 turns, 11 μ wide in ♂, 9 μ wide in ♀. Excretory pore 27-32 μ from anterior extremity. Ocelli 47-50 μ from anterior extremity. Esophagus 190 μ long, cylindroid. Tail 105-135 μ long. Anal body diameter, 43 μ.

Spicules 36 μ long. Gubernaculum 35 μ long. Preanally there occur four tuboid supplements, each 22-23 μ in length.

Habitat.—All four sites.

Geographical distribution.—Biscayne Bay, Florida (Wieser & Hopper, 1967).

Spirinia parasitifera (Bastian, 1865) Gerlach, 1963

Synonyms.—*Spira parasitifera* Bastian, 1865. For a complete list of synonyms, see Wieser & Hopper (1967).

Note.—The following is a condensation of the description of Florida specimens by Wieser & Hopper (1967).

Body 1.57 mm long. Cuticle with transverse striations. Maximum width, 55 μ. Head 22 μ wide, with four cephalic setae, 5 μ in length. Amphids 6 μ wide. Stoma small, with three minute teeth. Esophagus 140 μ long, terminated by a prominent basal bulb, 40 μ long by 36 μ wide. Tail 140-155 μ long, conoid. Anal body diameter, 24-28 μ.

Spicules 50 μ long, proximally cephalated.

Habitat.—Site C.

Geographical distribution.—Questionably cosmopolitan.

Remarks.—The questioned geographical distribution of *Spirinia parasitifera* is caused by uncertainties of past literature records. A comparison of these records suggests either that several different animals have been regarded as *S. parasitifera* or that the species has a high degree of morphological variation.

Microlaimus cyatholaimoides de Man, 1922
Figs. 11, 12

Cuticle with transverse striations. Maximum width 26-33 μ. Head 9 μ wide, bearing an anterior circle of six minute setae and a posterior circle of four cephalic setae, 4 μ in length. Body with numerous hypodermal glands arranged predominantly in four sublateral rows. A dorsal and a ventral row occur in the region between the amphid and the esophageal bulb. Posteriorly these glands are associated with short, fleshy setae. The setae are longest on the tail and diminish in size anteriorly. Amphid 5 μ wide (38-39 per cent of the corresponding body diameter), its anterior margin positioned 15-17 μ from the anterior extremity. Excretory pore 30 μ from anterior extremity. Stoma with a small dorsal tooth and 1-2 small subventral teeth. Esophagus 88-100 μ long, terminated by a large basal bulb. Tail obtusely conoid, 65-70 μ long.

Male 0.7 mm long; *a*, 27; *b*, 7.8; *c*, 11. Spicules 29 μ long (chord 25 μ), gubernaculum 18 μ long. Four minute pore-like preanal supplements.

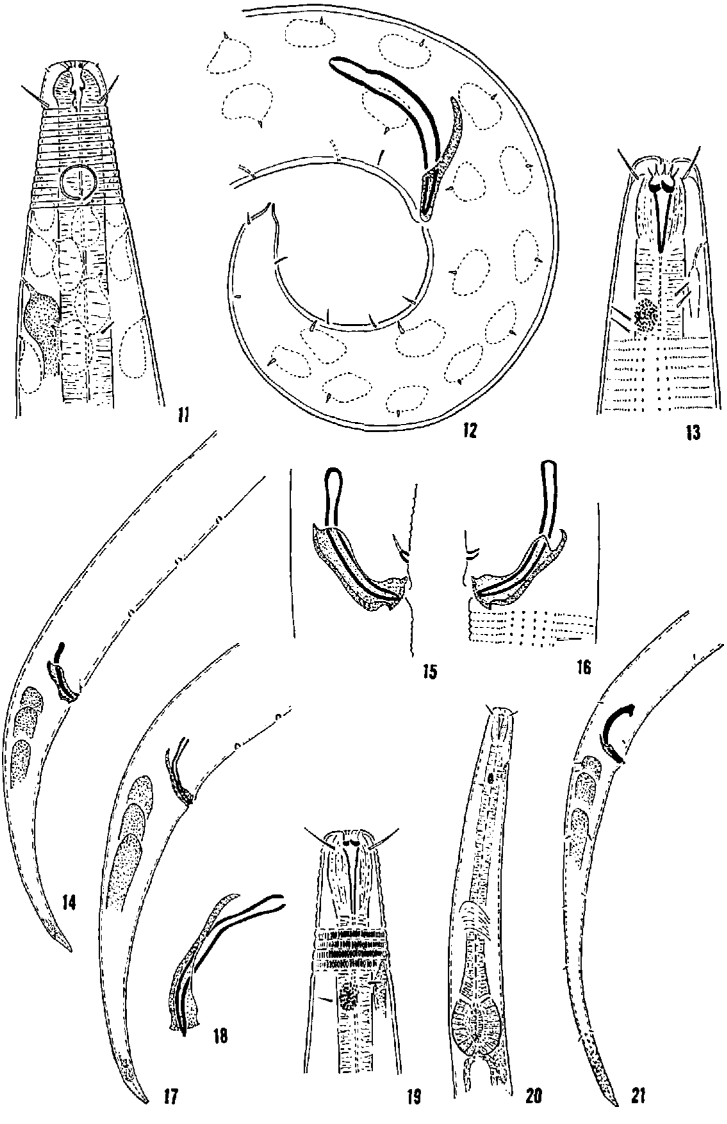
Female 0.65-0.7 mm long; *a*, 20-23; *b*, 7.0-7.4; *c*, 10; *V*, 47-51 per cent; didelphic, amphidelphic, ovaries reflexed.

Habitat.—Sites B and D.

Geographical distribution.—North Sea (de Man, 1922; Gerlach, 1950).

Remarks.—In identifying our specimens as *M. cyatholaimoides* we have encountered some uncertainties regarding the position of the vulva. The vulva position in our specimens of 47-51 per cent is at variance with that recorded by Gerlach (1951) (*viz.*, 75 per cent). However, in the original description, de Man states that the "Vulva . . . eine wening hinter der Körpermitte." Our value of 47-51 per cent would appear to be closer to the original description than Gerlach's.

Microlaimus texianus Chitwood, 1951, was described as distinct from *M.*



FIGURES 11-21. 11, *Microlaimus cyatholaimoides*, anterior end of male; 12, same, posterior end of male.—13, *Chromadora nudicapitata*, anterior end of male; 14, same, posterior end of male showing arrangement of supplements; 15-16, same, two views of spicular apparatus.—17, *Chromadora macrolaimoides*, posterior end of male showing arrangement of supplements; 18, same, spicular apparatus.—19, *Chromadorina epidemos*, anterior end of male; 20, same, esophageal region of male; 21, same, posterior end of male.

cyatholaimoides on the basis of Gerlach's description. Since the vulva position in the original description is only slightly behind the middle of the body length, this feature can no longer be used to separate Chitwood's species from *M. cyatholaimoides.* However, as Chitwood makes no mention of hypodermal glands we consider his species to be distinct by their absence.

Chromadora nudicapitata Bastian, 1865
Figs. 13-16

Synonyms.—For a complete list, see Wieser (1956, p. 616).

Cuticle with transverse rows of punctations, differentiated laterally into four longitudinal rows of larger punctations. Maximum width, 22-27 μ. Head 10 μ wide, with four cephalic setae, 5 μ in length. Somatic setae arranged in four sublateral rows, the anteriormost being paired. Amphids transversely oval, 4 μ wide. Stoma 12 μ long, armed at the anterior third with three small, solid teeth. Pigment spots present, 20-21 μ from anterior extremity. Excretory pore 11-13 μ from anterior extremity; renette cell 25-30 μ long, situated posterior to the base of the esophagus. Esophagus 108-110 μ long, terminated by a simple basal bulb, 23-24 μ long by 19-20 μ wide. Tails similar in both sexes, 90-93 μ long. Spinneret tube 4 μ long.

Male 0.64-0.69 mm long; *a*, 27-28; *b*, 5.9-6.9; *c*, 7.1-7.7. Spicules 22 μ long (chord 20 μ) with slight proximal cephalization. Gubernaculum 20 μ long, with a distal, minutely denticulated, dilation. Preanal supplements four in number, the posteriormost is minute and lies 5 μ in front of the anal opening. The other three are somewhat larger in size and extend 76-77 μ preanally. The male tail bears an anterior pair of minute papillae at 40 per cent of its length and a posterior pair 15 μ from the terminus.

Female 0.64 mm long; *a*, 24; *b*, 5.8; *c*, 7; *V*, 48 per cent; didelphic, amphidelphic, ovaries reflexed; their proximal extremities directed dorsally. The intestine passes to the left of the anterior gonad and to right of the posterior gonad. Eggs echinate, 35-40 μ long by 22-24 μ wide.

Habitat.—Sites A, C, and D.

Geographical distribution.—Cosmopolitan.

Chromadora macrolaimoides Steiner, 1915
Figs. 17, 18

Synonym.—*Chromadorella macrolaimoides* (Steiner, 1915) Filipjev, 1918.

Cuticle with transverse rows of punctations, differentiated laterally into four longitudinal rows of larger punctations. Maximum width 32-41 μ. Head 12-14 μ wide, with four cephalic setae, 7-8 μ in length. Stoma 16-

17 μ deep, armed at the anterior third with three small, solid teeth. Pigment spots present. Excretory pore 21-24 μ from anterior extremity. Esophagus 130-145 μ long, terminated by a double basal bulb, 33-35 μ long by 22-24 μ wide.

Male 0.82-0.88 mm long; *a*, 25-27; *b*, 6.1-6.8; *c*, 7.7-8.4. Spicules 27-29 μ long (chord 22-23 μ) with slight proximal cephalization. Gubernaculum 21 μ long, distally with a broad, minutely denticulated crura. Preanal supplements two in number, the posteriormost lies 28-29 μ preanal, the other, 18 μ anterior. Tail 105-110 μ long, 4.0-4.4 anal body diameters. Anal body diameter 25-26 μ.

Female 0.75-0.84 mm long; *a*, 21; *b*, 5.6-5.8; *c*, 7.2-7.3; *V*, 48-49 per cent; didelphic, amphidelphic, ovaries reflexed; their proximal extremities directed dorsally. The intestine passes to the left of the anterior gonad and to the right of the posterior gonad. Eggs minutely echinate, 37-42 μ long by 29 μ wide, up to three per uterus. Tail 102-115 μ long (4.8-5.5 anal body diameters). Anal body diameter 20-24 μ.

Habitat.—Sites A, B, and C.

Geographical distribution.—Sumatra (Steiner, 1915); Texas, Gulf Coast (Chitwood, 1951); Japan (Wieser, 1955); Biscayne Bay, Florida (Wieser & Hopper, 1967).

Chromadorina epidemos, n. sp.
Figs. 19-22b

Cuticle with transverse rows of punctations; no lateral differentiation. Maximum width 20-30 μ. Head 8-9 μ wide, with four cephalic setae 5-6 μ in length. Somatic setae 2 μ long, arranged in four sublateral rows. Amphids transversely oval, 3 μ wide. Stoma 11-12 μ deep, armed at the anterior fifth with three small, solid teeth. Pigment spots present, 18-20 μ from anterior extremity. Excretory pore 16-20 μ from anterior extremity; renette cell posterior to base of esophagus. Esophagus 90-118 μ long, terminated by a single, basal bulb, 21-23 μ long by 17-19 μ wide. Tails similar in both sexes, 96-130 μ long (6.7-8.7 anal body diameters). Anal body diameter 14-19 μ. Spinneret tube 4-5 μ long.

Male 0.61-0.78 mm long; *a*, 26-37; *b*, 5.5-6.6; *c*, 5.3-6.0. Spicules 26-30 μ long (chord 18-21 μ) semicircularly bent, proximally cephalated, the cephalization bearing a ventral projection (cf. figs. 22a, b). Gubernaculum 14-15 μ long, distally with a narrow, minutely denticulated, dilation. Preanal supplements absent.

Female 0.52-0.69 mm long; *a*, 19-24; *b*, 5.7-6.7; *c*, 4.8-5.8; *V*, 43-46; didelphic, amphidelphic, ovaries reflexed, their proximal extremities directed dorsally. The intestine passes to the left of the anterior gonad and to the right of the posterior gonad. Eggs coarsely rugose, 34 μ long by 22 μ wide.

Habitat.—Sites A, B, and C.

Holotype specimen.—Male; Canadian National Collection of Nematodes, Entomology Research Institute, Ottawa, Collection Number 4877a, Type Slide No. 142. Type locality, Site C, Key Biscayne, Florida.

Allotype specimen.—Female with same data as above, on Type Slide No. 142a.

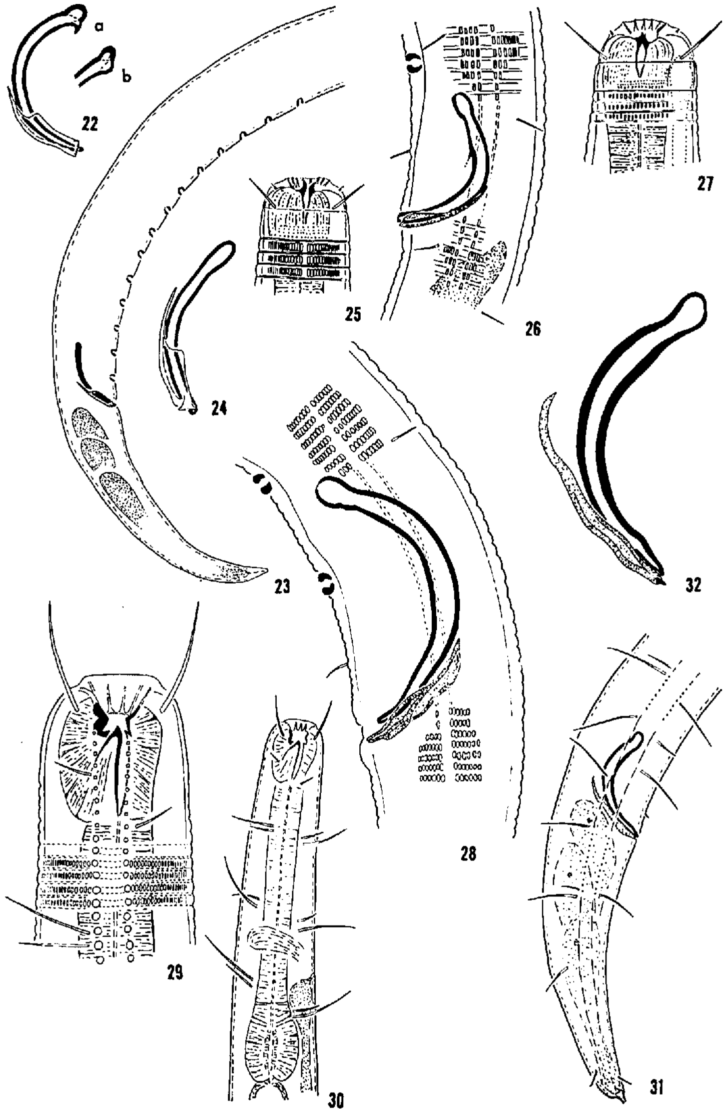
Paratypes.—30 ♀♀ and 10 ♂♂ on Type Slide Nos. 142b-j; Canadian National Collection of Nematodes Nos. 4875 d, g, 4876a and 4877 a-c; from Sites A-C.

Differential diagnosis.—*Chromadorina epidemos* n. sp. is most closely related to the group of *Chromadorina* species in which the males lack preanal supplements. *C. epidemos* can be distinguished from all the species within this group by the presence of a ventral projection on the proximal cephalization of the spicules. In addition, the species can be specifically distinguished from these forms by the following: the short somatic setae separate it from *C. bioculata* (Schultze, 1858) which has long somatic setae; the absence of a postanal papilla and the saline habitat distinguish it from *C. astacicola* (Schneider, 1932) which is a fresh water form; its long slender tail is sufficient to separate it from both *C. rognoensis* (Allgén, 1932) and *C. granulopigmentatus* (Wieser, 1951) both of which have obtusely conoid tails. The semicircularly bent spicules separate it from both *C. macropunctata* (Wieser, 1954) and *C. inversa* Wieser, 1955; and lastly, the lack of both the paired cervical setae and the two preanal setae serve to distinguish it from *C. incurvata* Wieser, 1955.

Chromadorina germanica (Bütschli, 1874) Wieser, 1954
Figs. 23, 24

Synonyms.—*Chromadora germanica* Bütschli, 1874; *Prochromadorella germanica* (Bütschli, 1874) auctores; *Chromadora minor* Cobb, 1893; *Prochromadora minor* (Cobb, 1893) Filipjev; *Heterochromadora germanica* (Bütschli, 1874) Wieser, 1952.

Cuticle with transverse rows of punctations; no lateral differentiation. Maximum width 27-29 μ. Head 12-13 μ wide, with four cephalic setae, 6 μ in length. Stoma 13-14 μ deep, anteriorly armed with three small, solid teeth. Pigment spots present, 22-23 μ from anterior extremity. Esophagus 106-120 μ long, terminated by a single basal bulb, 24 μ long by 21 μ wide. Tails similar in both sexes, 85-102 μ long (4.3-6.4 anal body diameters). Anal body diameter, 16-22 μ. Spinneret tube 4 μ long.



FIGURES 22-32. 22a, *Chromadorina epidemos*, spicular apparatus; 22b, same, variation in proximal cephalation.—23, *Chromadorina germanica*, posterior end of male showing arrangement of supplements; 24, same, spicular apparatus.—25, *Prochromadorella neapolitana*, anterior end of male; 26, same, spicular apparatus.—27, *Prochromadorella micoletzkyi*, anterior end of male; 28, same, spicular apparatus.—29, *Hypodontolaimus pilosus*, anterior end of female; 30, same, esophageal region of female; 31, same, posterior end of male; 32, same, spicular apparatus.

Male 0.6-0.77 mm long; *a*, 29; *b*, 5.7-6.4; *c*, 7.1-8.1. Spicules 28 μ long (chord 25 μ). Gubernaculum 20 μ long, distally bearing lateral teeth. Preanal supplements 14-15 in number.

Female 0.64 mm long; *a*, 24; *b*, 5.5; *c*, 6.3; *V*, 50 per cent; didelphic, amphidelphic, ovaries reflexed, their proximal extremities directed dorsally. The intestine passes to the left of the anterior gonad and to the right of the posterior gonad. Eggs minutely echinate, 38-41 μ long by 22-24 μ wide; one egg per uterus.

Habitat.—Site D.

Geographical distribution.—North Sea, Mediterranean Sea (auctores), Puget Sound, Washington (Wieser, 1959a). In addition to the present Florida record the species occurs in algae along the shores of Rhode Island and New Jersey (unpublished data).

Atrochromadora denticulata Wieser & Hopper, 1967

Note.—The following is a condensation of the original description presented by Wieser & Hopper (1967).

Body 0.79-0.80 mm long. Cuticular ornamentation beginning with transverse rows of punctations, followed by annules. Lateral differentiation present in form of two longitudinal rows of coarser punctations, 6 μ apart at mid-body. Maximum width, 31-32 μ. Head 11 μ wide, with four cephalic setae, 5-6 μ in length. Stoma with three small, solid teeth. Esophagus 96-109 μ long, terminated by a small basal bulb. Tails similar in both sexes, 124-128 μ long. Anal body diameter, 28 μ in ♂, 20 μ in ♀.

Spicules 34 μ long, semicircularly bent. Gubernaculum 23μ long, with distal denticulated dilation.

Female *V*, 46 per cent; didelphic, amphidelphic, ovaries reflexed.

Habitat.—Sites A, B, and C.

Geographical distribution.—Biscayne Bay, Florida (Wieser & Hopper, 1967).

Prochromadorella neapolitana (de Man, 1876) Micoletzky, 1924
Figs. 25, 26

Synonyms.—*Chromadora neapolitana* de Man, 1876; *Chromadora procera* Micoletzky, 1922.

Cuticle with transverse rows of punctations; oval to rod-shaped and closely approximated in adults, dot-like and widely spaced in juveniles. Lateral differentiation often present on adults (adanally or over entire body). Maximum width, 24-32 μ. Head 11-12 μ wide, with four cephalic setae 5-6 μ in length. Stoma armed with three small, solid teeth. Esophagus

125-132 μ long, terminated by an elongated basal enlargement. Tails similar in both sexes, 120-134 μ long (6-8 anal body diameters). Anal body diameter, 17-20 μ.

Male 0.93-0.94 mm long; *a*, 36-39; *b*, 7.4-7.5; *c*, 7.2-7.7. Spicules 26-30 μ long (chord 19-24 μ), proximally cephalated and with a ventral projection (attachment point of velum or of protractor muscles?). Gubernaculum 14 μ long, distal extremity laterally flanged. Preanal supplements five in number, the posteriormost located opposite the proximal extremity of the spicules. A 3 μ long preanal seta occurs in the region between the anus and the supplement series.

Female 0.88 mm long; *a*, 28; *b*, 6.7; *c*, 6.6; *V*, 46 per cent; didelphic, amphidelphic, ovaries reflexed.

Juvenile males 0.50 mm long; *a*, 25-28; *b*, 5.0; *c*, 6.3-6.5.

Juvenile female 0.54 mm long; *a*, 24; *b*, 5.2; *c*, 5.7; *V*, 48 per cent.

Habitat.—Sites A, B, and C.

Geographical distribution.—Mediterranean Sea (de Man, 1876, Allgén, 1942, Schuurmans-Stekhoven, 1942, 1943); Red Sea (Suez) (Micoletzky, 1923). Wieser's 1956 record from Greece is questionable as his figure of the spicules (Fig. 10) is entirely different than that figure by de Man (Fig. 17a).

Remarks.—A study of the juveniles of this species presents some interesting data. It appears that the presence of lateral differentiation is associated with age. A complete gradation in cuticular ornamentation occurs from very young individuals with a light cuticle bearing widely spaced dots, to mature animals having a typically darkened cuticle with coarse oval or rod-shaped markings. The juvenile specimens present no indication of lateral differentiation, nor do the young adults. In older adults lateral differentiation is manifest in various forms, the most common being an alate formation in the esophageal and adanal regions. Some specimens possess a slight lateral wing along the entire body.

Young males have been observed which possess only the five preanal supplements, while in others the distal extremity of the spicules can also be distinguished. The spicules can be either missing entirely with only a trace of the gubernaculum showing, or, the faint outline of both structures may be observed.

Prochromadorella micoletzkyi Chitwood, 1951
Figs. 27, 28

Synonym.—*P. chitwoodi* Timm, 1952.

Cuticle with transverse rows of oval punctations; lateral differentiation present or absent. Maximum width 26 μ. Head 15 μ wide, with four cephalic setae 7 μ in length. Stoma armed with three small, solid teeth. Esophagus 122-127 μ long, terminated by an elongated basal enlargement. Tail 115-122 μ long (5.1-5.2 anal body diameters). Anal body diameter 22-24 μ.

Male 0.87-0.88 mm long; *a*, 34; *b*, 6.9-7.1; *c*, 7.2-7.6. Spicules 46 μ long (chord 35 μ), proximally cephalated. Gubernaculum 20 μ long, strongly developed; with lateral tooth at distal extremity. Preanal supplements five in number, the posteriormost located posterior to the proximal extremity of the spicules. A 4 μ long preanal seta occurs between the anus and the supplements series.

Habitat.—Site D.

Geographical distribution.—Aransas Bay, Texas (Chitwood, 1951); Chesapeake Bay, Maryland (Timm, 1952).

Remarks.—*Prochromadorella micoletzkyi* Chitwood, 1951 and *P. chitwoodi* Timm, 1952, have been considered as synonyms of *P. paramucrodonta* (Allgén, 1929). However, on the basis of the structure of the gubernaculum these species are distinct from Allgén's species. As the only difference between *P. micoletzkyi* and *P. chitwoodi* is the development of lateral differentiation, we consider Timm's species a synonym of Chitwood's.

Hypodontolaimus pilosus, n. sp.
Figs. 29-32

Cuticle with transverse rows of oval punctations; lateral differentiation present in the form of a longitudinal wing bordered on either side by a row of very coarse punctations. The striations of the body continue across the lateral wing and give the appearance of transverse bars connecting the coarse longitudinal punctations. Maximum width 39-49 μ. Head 18-20 μ wide, with four cephalic setae, 15-16 μ in length. Somatic setae arranged in four sublateral rows; frequently in pairs of two different lengths. The longest member of the pair is 20-30 μ long, while the short member is 10 μ long. Stoma 18-20 μ deep, armed with a large, hollow, dorsal tooth and 1 (2?) subventral denticle. Stomatal musculature pronounced, especially dorsally. Esophagus 115-127 μ long, terminated by a single basal bulb, 20-22 μ long by 18-19 μ wide. Excretory pore 80-88 μ from anterior extremity (slightly posterior to nerve ring). Renette cell extending 65 μ posterior to eosphagus. Tails similar in both sexes, obtusely conoid, 97-118 μ long (3.1-4.2 anal body diameters). Anal body diameter, 26-32 μ.

Male 0.76-0.91 mm long; *a*, 16-19; *b*, 6.4-7.1; *c*, 7.8-8.7. Spicules 49-50 μ long (chord 39-44 μ). Gubernaculum 30-34 μ long, distally with two teeth, one directed ventrally, the other laterally. Preanal supplements absent. A short (3 μ long) preanal seta is present.

Female 0.68-0.82 mm long; *a*, 17-18; *b*, 5.9-6.6; *c*, 6.9-7.5; *V*, 48-50 per cent; didelphic, amphidelphic, ovaries reflexed, their proximal extremities directed dorsally. The intestine passes to the left of the anterior gonad and to the right of the posterior gonad.

Habitat.—Site A.

Holotype specimen.—Male, Canadian National Collection of Nematodes, Entomology Research Institute, Ottawa, Collection Number 4875c, Type Slide No. 143. Type Locality, Site A, Virginia Key, Florida.

Allotype specimen.—Female, Canadian National Collection Number 4875a, Type Slide No. 143a, from Site A.

Paratypes.—11 ♀♀, 8 ♂♂, on Type Slide Nos. 143b-i; Canadian National Collection Nos. 4875a-c; from Site A.

Locality, Site A, Virginia Key, Florida.

Differential diagnosis.—*Hypodontolaimus pilosus* n. sp. belongs to the group of *Hypodontolaimus* species with somatic setae which are longer than the corresponding head diameter (Group A in Wieser's 1954 key). *H. pilosus* is most closely related to *H. colesi* Inglis, 1962, by its first circle of papilloid cephalic sense organs. However, the species can be distinguished by the *paired* somatic setae, their shorter length (10-30 μ vs. 31-47 μ) and by the short, obtuse tail.

Spilophorella paradoxa (de Man, 1888) Filipjev, 1918

Synonym.—*Spilophora paradoxa* de Man, 1888.

Note.— See Chitwood (1951, p. 635, fig. 6, A-D).

Cuticle with transverse rows of punctations; lateral differentiation present in the form of two longitudinal rows of coarse punctations which are 4-5 μ apart in the mid-body region. The striations of the body continue across the lateral area and give the appearance of transverse bars connecting the coarse punctations. Maximum width 29-36 μ. Head 9 μ wide, with four cephalic setae 3-4 μ in length. Short (3 μ) somatic setae arranged in four sublateral rows; four pairs of "cervical" setae at base of stoma. Stoma 14-15 μ deep, armed with a large, solid, dorsal tooth. Esophagus 120-145 μ long, terminated by a double basal bulb, 35-40 μ long by 20-23 μ wide. Tails similar in both sexes, 113-130 μ long (5.1-6.2 anal body diameters). Anal body diameter 21-22 μ. Spinneret tube 22-23 μ long.

Male 0.63 mm long; *a*, 22; *b*, 5.3; *c*, 5.6. Spicules 38 μ long (chord 32 μ). Gubernaculum 20 μ long, distally dentate. A short, 2 μ long, seta is present immediately preanal, with four minute, pore-like supplements more anterior.

Female 0.81 mm long; *a*, 23; *b*, 5.6; *c*, 6.3; *V*, 46 per cent; didelphic, amphidelphic, ovaries reflexed, their proximal extremities directed dorsally. The intestine passes to the left of the anterior gonad and to the right of the posterior gonad. Eggs 41-43 μ long by 25 μ wide, one per uterus.

Habitat.—All four sites.

Geographical distribution.—Cosmopolitan.

Remarks.—The present record of supplements in males of *Spilophorella paradoxa* conflicts with previous descriptions. However, the supplements, rather than being typically chromadoroid, are merely represented by darker lines running obliquely through the preanal cuticle; thus, these supplements may easily escape detection. We hesitate to attach any special taxonomic importance to this observation without an examination of European representatives.

Euchromadora de Man, 1886

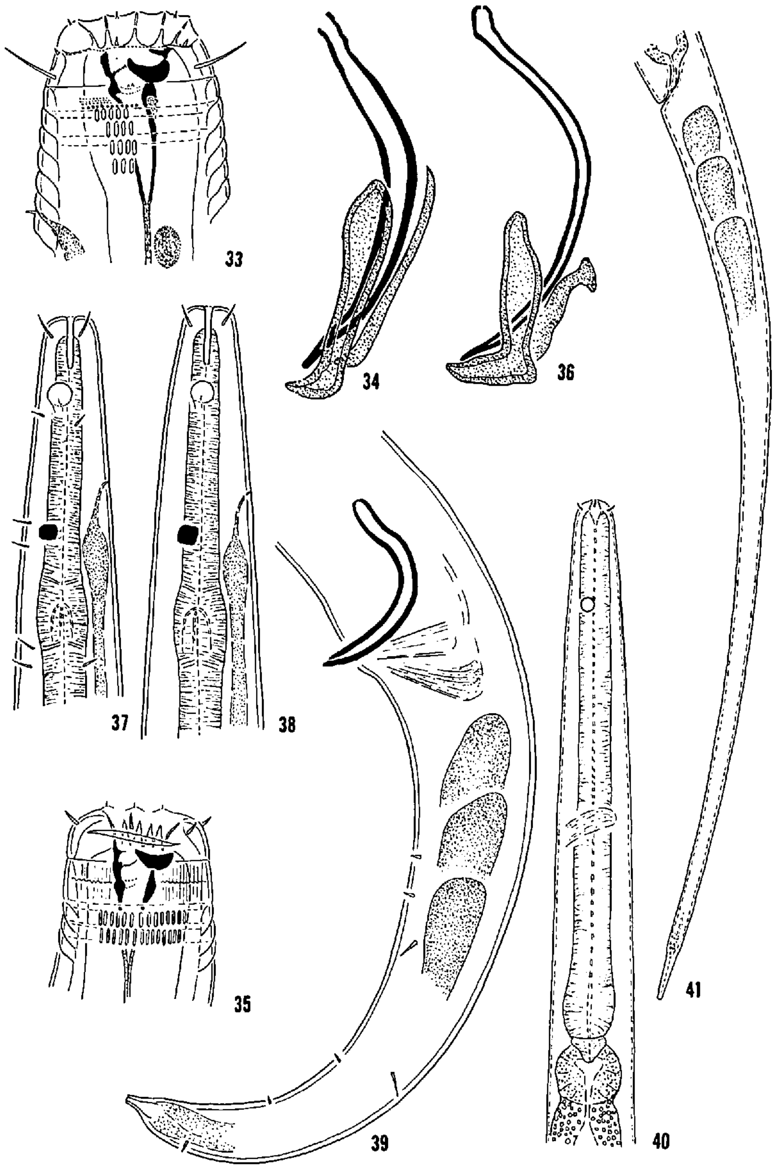
Detailed descriptions of the two species of *Euchromadora* encountered in our study can be found in the works of Coles, 1965 (*E. gaulica*), and Wieser & Hopper, 1967 (*E. gaulica* and *E. meadi*).

Euchromadora gaulica Inglis, 1962
Figs. 33, 34

Synonyms.—*Euchromadora striata sensu* Chitwood, 1951; *E. chitwoodi* Coles, 1965; *E. africana* Schuurmans-Stekhoven, 1950 (nec v. Linstow, 1908); *E. tridentata* Wieser, 1951 (nec Allgén, 1929).

Body with transverse rows of hexagonal punctations; lateral differentiation absent. Maximum width, 57 μ. Head 22 μ wide, with a circle of six slender labial setose papillae, and two circles of cephalic setae. Anterior circle of six cephalic setae short, fleshy; posterior circle of four, 7-9 μ long. Stoma armed with a large, movable dorsal tooth, opposed by a denticulated ridge. Posteriorly several individual denticles occur. Pigment spots present, 30 μ from anterior extremity. Excretory pore 25 μ from anterior extremity; a short seta occurs at this position. Esophagus 260 μ long, terminated by a gradual basal enlargement.

Male 1.47 mm long; *a*, 26; *b*, 5.7; *c*, 8.0. Spicules 50 μ long (chord 45 μ). Dorsal members of gubernaculum 28 μ long, lateral pieces 29 μ long, distally acute with two minute subterminal denticles. Tail 185 μ long (5.6 anal body diameters). Anal body diameter, 33 μ.



FIGURES 33-41. 33, *Euchromadora gaulica*, anterior end of male; 34, same, spicular apparatus.—35, *Euchromadora meadi*, anterior end of male; 36, same, spicular apparatus.—37, *Araeolaimus texianus*, anterior end of male showing cervical setae; 38, same, anterior end of another male, in which no setae were seen; 39, same, posterior end of male.—40, *Monhystera parelegantula*, esophageal region of female; 41, same, posterior end of female.

Habitat.—All four sites.

Geographical distribution.—Gulf of Mexico, Texas (Chitwood, 1951); Mediterranean Sea (Inglis, 1962); British Isles (Coles, 1965); Biscayne Bay, Florida (Wieser & Hopper, 1967). The species has also been observed from Woods Hole on slides in the Cobb collection from Woods Hole.

Euchromadora meadi Wieser & Hopper, 1967
Figs. 35, 36

Body with transverse rows of hexagonal punctations; lateral differentiation absent. Maximum width 40 μ. Head 19 μ wide, with a circle of six small labial papillae and a single circle of six small labial papillae and a single circle of six cephalic setae, 2-3 μ in length. Stoma armed with a large, movable dorsal tooth, opposed by a sparsely denticulated ridge. No posterior denticles observed. Pigment spots absent. Excretory pore not observed. Esophagus 220 μ long, terminated by a gradual basal enlargement.

Male 1.52 mm long; *a*, 38; *b*, 6.9; *c*, 8.6. Spicules very slender, 56 μ long (chord 46 μ), proximally cephalated. Dorsal member of gubernaculum 18 μ long, with characteristic proximal projections; lateral pieces 22 μ long, hammer-shaped. Tail 176 μ long (5.1 anal body diameters). Anal body diameter 34 μ.

Habitat.—Only at Site C.

Geographical distribution.—Biscayne Bay, Florida (Wieser & Hopper, 1967).

Remarks.—This species, originally described from sediment collected in the vicinity of Site B, subsequently has been found in the sediment and on *Thalassia* leaves at Site C.

Syringolaimus striatocaudatus de Man, 1888

Synonym.—*Syringolaimus smargidus* Cobb, 1928.

Note.—See Cobb (1928, p. 399, fig. 1) and Chitwood (1951, p. 647, fig. 9, I-K) (species listed as *S. smargidus*).

Transverse striations prominent only on the tail. Maximum width 15-22 μ. Head 8-9 μ wide, without cephalic setae. Stoma cylindroid, 31-36 μ long, armed at its anterior extremity with three small, solid teeth. Esophagus 113-125 μ long, terminated by a single basal bulb, 16-19 μ long by 11-16 μ wide. Excretory pore 58-62 μ from anterior extremity. Anterior 15-20 μ of intestine modified into a progaster (ventriculus acc. Cobb). Tail similar in both sexes, 80-108 μ long, prominently striated, with phasma at middle. Terminal 9-10 μ of tail without striations. Spinneret tube, conoid, 5-6 μ long.

Male 4.5-4.8 mm long; *a*, 28-31; *b*, 4.0-4.1; *c*, 5.6-5.7. Spicular chord 15 μ. Gubernaculum 7 μ long. No preanal supplements.

Female 0.52-0.61 mm long; *a*, 28-29; *b*, 4.9-5.1; *c*, 5.4-5.7; *V*, 54 per cent; didelphic, amphidelphic, ovaries reflexed. The intestine passes to the dorsal side of the gonads.

Habitat.—All four sites.

Geographical distribution.—Cosmopolitan.

Araeolaimus texianus Chitwood, 1951
Figs. 37-39

Cuticle with fine, transverse striations. Maximum width, 19-24 μ. Head 6-7 μ wide, with four cephalic setae, 3-4 μ in length. Cervical setae present or absent (compare figs. 32 and 33). Amphid spiral to shepherd's crook, 3 μ wide; its anterior margin positioned 8-9 μ from anterior extremity. Stoma narrow, cylindrical, 7 μ long; unarmed. Ocelli 27-29 μ from anterior extremity. Excretory pore 22-24 μ from anterior extremity; terminal excretory duct 7-8 μ long; renette cell 78 μ behind base of esophagus, about 30 μ long by 13 μ wide. A small pseudocoelomocyte occurs immediately posterior to the renette cell. Esophagus 112-123 μ long. Tails similar in both sexes, 80-95 μ long (about 4.5 anal body diameters). Anal body diameter, 17-21 μ.

Male 0.71-0.91 mm long; *a*, 37-41; *b*, 6.3-7.4; *c*, 8.3-9.9; diorchic, testes in tandem, extended anteriorly. Spicules sickle-shaped, 25-28 μ long (chord 19-21 μ). Gubernaculum indistinct, apparently hidden by dense musculature.

Female 0.77 mm long; *a*, 32; *b*, 6.4; *c*, 9.6; *V*, 55 per cent; didelphic, amphidelphic, ovaries outstretched.

Habitat.—All four sites.

Geographical distribution.—Rockport Harbor, Texas (Chitwood, 1951); Arabian Sea, Karachi, West Pakistan (Timm, 1963).

Theristus (*Cylindrotheristus*) *fistulatus* Wieser & Hopper, 1967

Note.—See Wieser & Hopper (1967, pl. 36, fig. 80, a-d).

Body 0.86-1.04 mm long. Cuticle with transverse striations. Maximum width, 30-36 μ. Head 15 μ wide, with six labial papillae and ten to twelve cephalic setae, 13 + 11 μ in length. Cervical and somatic setae present. Amphids circular, 8-9 μ wide (40-45 per cent of corresponding body diameter); 15-18 μ from anterior extremity. Esophagus 144-180 μ long, cylindroid-conoid. Tails similar in both sexes, 210-228 μ long. Anal body diameter 23-26 μ.

Spicules 25-27 μ long, proximally cephalated. Gubernaculum sleeve-like, without apophysis.

Female monodelphic, prodelphic, ovary outstretched.

Habitat.—Site C.

Geographical distribution.—Biscayne Bay, Florida (Wieser & Hopper, 1967).

Monhystera Bastian, 1865

Several authors have called attention to an anterior differentiation of the intestine into a region termed the "progaster" (Steiner, 1958; Chitwood & Murphy, 1964). It has been suggested that the presence or absence of this intestinal differentiation might be significant in species identification. While this may be true, its presence in each of the four Florida *Monhystera* species seems to indicate that the progaster is more common than heretofore considered. The anterior portion of the intestine of each of the Florida *Monhystera* species, in varying degrees, is set off from the remainder of the intestine by the clear first few cells, *i.e.*, they lack the same type of cellular inclusions present in the remaining intestinal cells.

Monhystera parelegantula de Coninck, 1943
Figs. 40, 41

Body 0.41 mm long. Cuticle smooth, without striations or punctations. Maximum width, 12 μ. Head 4 μ wide, with six cephalic setae, approximately 1 μ in length (1/4 head diameter). Amphids circular, 2 μ wide (about 25 per cent of the corresponding body diameter), its anterior margin positioned 12 μ from anterior extremity. No cervical or somatic setae observed. Esophagus 67 μ long, cylindrical, with slight terminal swelling. Prominent progaster present, 7 μ long, vulva at 50-53 per cent. Vulva-anal distance, 74-80 μ. Egg 25 μ long by 9 μ wide, occurring one at a time. Tail 105-120 μ long (15 anal body diameters). Anal body diameter, 8 μ. Terminal spinneret tube 7 μ long. The three spinneret glands are found in the anterior fourth of the tail.

Male.—Unknown from Florida.

Habitat.—Sites A and D.

Geographical distribution.—North Atlantic, Iceland (de Coninck, 1943); Arabian Sea, Karachi, West Pakistan (Timm, 1963).

Remarks.—The original description of this species did not mention an anterior differentiation of the intestinal cells or the long spinneret tube. While the first character could have been easily overlooked, the second is questionable. With its long spinneret tube, the Florida specimens resemble *M. lepidura* Andrássy, 1962, which is separated from *M. parelegantula* by the more forward position of the amphid.

Monhystera ocellidecoris, n. sp.
Figs. 42, 43

Cuticle smooth, without striations or punctations. Maximum width, 12 μ. Head 6 μ wide, with ten cephalic setae, approximately 2 μ in length (1/3 head diameter). Amphid circular, 3 μ wide (about 40 per cent of corresponding body diameter), its anterior margin positioned 7 μ from anterior extremity. Small ocelli present at level of amphid. At twice this distance from the anterior extremity prominent, 5 μ long, cervical setae occur, the anteriormost of which occur in pairs. Posteriorly they, as well as the somatic setae *per se*, occur singly. Esophagus 85 μ long, cylindrical, with slight terminal swelling. Progaster present.

Male 0.40 mm long; *a*, 34; *b*, 5.0; *c*, 5.0. Spicules 18 μ long, uniformly curved, divisible into an elongate, cephalated proximal region set off by a constriction from the distal lamina. Lamina with a ventral-dorsal ridge and a ventral velum. Gubernaculum parallel to spicules, 5 μ long, the distal extremities extend forward and laterally around the tips of the spicules. Tail 80 μ long (about 8 anal body diameters), the anterior two-thirds cylindro-conoid, then narrowing to cylindroid terminal one-third. Anal body diameter, 10 μ. The three spinneret glands occupy the cylindro-conoid section of the tail.

Female unknown.

Habitat.—Site A.

Holotype specimen.—Male; Canadian National Collection of Nematodes, Entomology Research Institute, Ottawa, Collection Number 4875a, Type Slide No. 144. Type Locality, Site A, Virginia Key, Florida.

Paratype.—One ♂ with same data as above, on Type Slide No. 144a.

Differential diagnosis.—*Monhystera ocellidecoris* n. sp. belongs to the small group of *Monhystera* species with ocelli. Within this group the species most closely resembles *M. refringens* Bresslau & Schuurmans-Stekhoven in Schuurmans-Stekhoven, 1935, from which it is easily distinguished by the absence of a prominent postanal papilla. In addition, the ocelli in *M. ocellidecoris* are slightly more anteriorly disposed, the cervical setae are relatively longer and the spicules and gubernaculum are significantly distinct.

Monhystera dubicola, n. sp.
Figs. 44, 45

Cuticle smooth, without striations or punctations. Maximum width, 16

μ. Head 5 μ wide, with six cephalic setae, approximately 1 μ in length (1/5 head diameter). Amphid circular, 2 μ wide (about 30 per cent of corresponding body diameter), its anterior margin positioned 9 μ from the anterior extremity. A few short cervical setae occur on the neck region. Esophagus 73 μ long, cylindrical. Progaster present.

Female 0.33-0.37 mm long; *a*, 23; *b*, 4.6-5.1; *c*, 4.6-4.7; *V*, 56-61 per cent; monodelphic, prodelphic, ovary outstretched, 88 μ in length. Vulva-anal distance, 64-82 μ. Tail 70-80 μ long (7-8 anal body diameters), anterior half cylindro-conoid, narrowing gradually to cylindroid terminal half. Anal body diameter, 10 μ. The three spinneret glands are in the anterior third of the tail.

Male unknown.

Habitat.—Site A.

Holotype specimen.—Female; Canadian National Collection of Nematodes, Entomology Research Institute, Ottawa, Collection Number 4875c, Type Slide No. 145. Type Locality, Site A, Virginia Key, Florida.

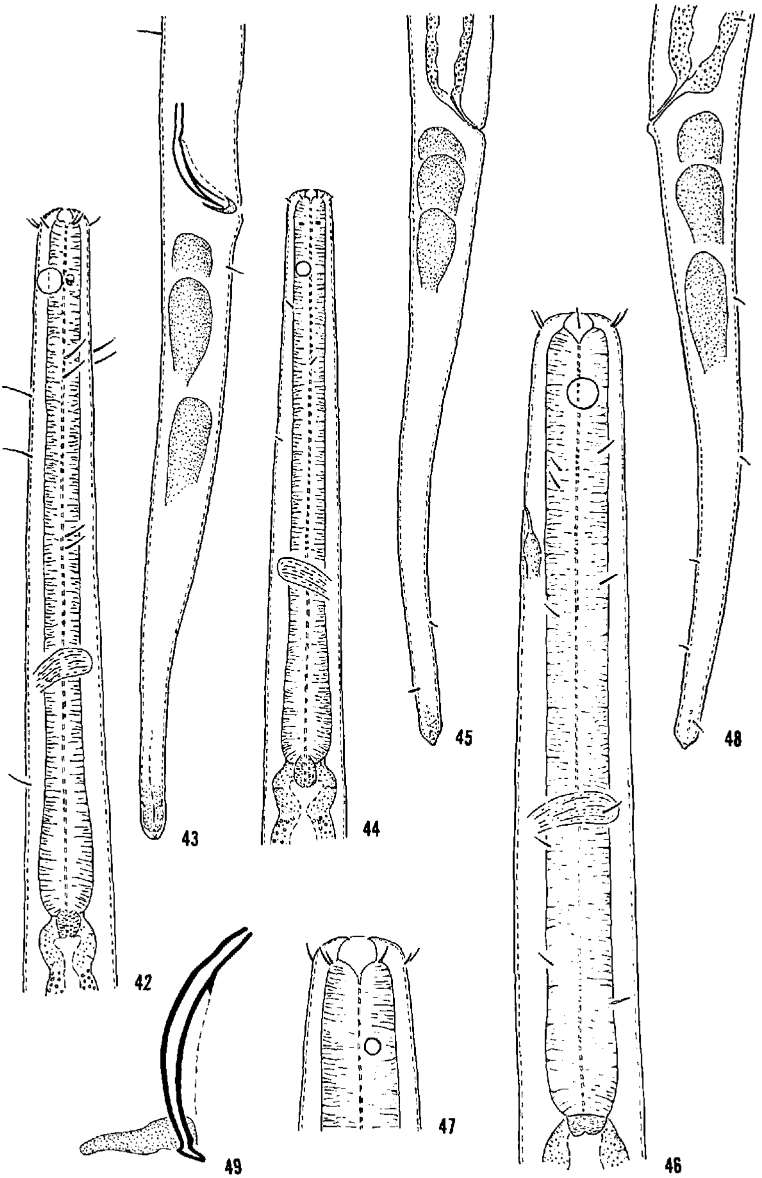
Paratypes.— 6 ♀♀ on Type Slide Nos. 144a, 145a-c; Canadian National Collection Nos. 4875b, c; from Site A.

Differential diagnosis.—Following the key provided for *Monhystera* by Wieser (1956), *M. dubicola* n. sp. belongs to the group of *Monhystera* species which lack ocelli and have the amphids located 1 to 1.9 head diameters behind the anterior extremity. These species are further divided into two groups, one with filiform tails which are at least 9 anal body diameters in length and the other in which the tails are clavate or attenuate and shorter than 6 anal body diameters. *M. dubicola*, with a tail 7-8 anal body diameters in length, occupies an intermediate position between these two groups. While the stability of the tail length-anal body diameter ratio is undetermined for virtually all marine nematode species, we nevertheless currently accept this character at its face value and use it for separation of our species from Wieser's two groups.

Monhystera parva (Bastian, 1865) de Man, 1888
Figs. 46-49

Synonyms.—*Tachyhodites parvus* Bastian, 1865; *Monhystera parva* var. *meridiana* Micoletzky, 1922; *M. heteroparva* Micoletzky, 1924; *M. kossnensis* Paramonov, 1929; *M. antarctica* Cobb, 1914.

Male 0.58-0.63 mm long; *a*, 29-31; *b*, 5.6; *c*, 6.1-6.3. Maximum width, 20 μ. Head 9-10 μ wide, with ten cephalic setae, approximately 4 + 3 μ in length (40 per cent of head diameter). Amphid circular, 4 μ wide (about 33 per cent of corresponding body diameters), its anterior margin posi-



FIGURES 42-49. 42, *Monhystera ocellidecoris*, esophageal region of male; 43, same, posterior end of male.—44, *Monhystera dubicola*, esophageal region of female; 45, same, posterior end of female.—46, *Monhystera parva*, esophageal region of male; 47, same, anterior end of young female; 48, same, posterior end of female; 49, same, spicular apparatus.

tioned 8 μ from anterior extremity (slightly less than one head diameter). Cervical setae present. Excretory pore 25 μ from anterior extremity. Esophagus 103-111 μ long, cylindroid. Indistinct progaster present.

Spicules 32 μ long (chord 27 μ), uniformly bent, with a ventral projection near the proximal end. Distal extremity unique, somewhat recurved (Fig. 44). Gubernacular apophysis 12 μ long. Tail 95-100 μ long (5 anal body diameters). Anal body diameter, 18 μ. Spinneret glands in anterior half of tail.

Female 0.42-0.49 mm long; *a*, 19; *b*, 4.3-4.4; *c*, 6.1-6.3; *V*, 48-58 per cent; monodelphic, prodelphic, ovary outstretched. Maximum width, 26 μ. Head 8-9 μ wide. Cephalic setae 3 + 2 μ in length (33 per cent of head diameter). Amphid circular, 2.0-2.5 μ wide (20-25 per cent of corresponding body diameter), its anterior margin positioned 6-7.5 μ from anterior extremity. Somatic setae 3 μ long. Reproductive system 88-180 μ long. Vulva-anal distance 95-145 μ. Tail 80-105 μ long (5-6 anal body diameters). Anal body diameter, 18 μ.

Young female 0.31 mm long; *a*, 22.5; *b*, 3.9; *c*, 4.8; *V*, 63 per cent.

Habitat.—All four sites.

Geographical distribution.—Cosmopolitan.

Sumario

Nemátodos Marinos Epifillos en la Yerba de Tortugas, *Thalassia testudinum* König, en la Bahía de Biscayne, Florida

Estudios de la ecología y taxonomía de los nemátodos epifillos en yerba de tortugas, *Thalassia testudinum* König, en cuatro sitios separados en la Bahía de Biscayne, Florida, han revelado disimilitudes importantes en especiación y dinámicas de población. Las tendencias en la distribución de especies dominantes en los distintos lugares puede ser indicativa de diferencias fisiográficas entre áreas. En general, la mayoría de las muestras estuvieron representadas por comparativamente poca taxa que comprendió la mayor biota de nemátodos de la colección en particular. Se nota la abundancia de los cromadóridos, especialmente *Chromadora macrolaimoides*. El tipo de alimentación a base del epicrecimiento (2-A) comprendió del 58 al 85 por ciento de la fauna total de nemátodos. Dentro de los límites de este estudio, no se ha observado correlaciones entre el tipo y cantidad del epicrecimiento de algas y la especificidad de la colonización de los nemátodos. La población béntica de nemátodos en comunidades de yerba de tortugas, difiere notablemente de la biota foliculosa. Se presenta una clave para las especies más comúnmente encontradas junto con descripciones de los nemátodos identificados y la nueva distribución de habitat. Se han hecho observaciones apropiadas en especies previamente

descritas. Cuatro especies hasta ahora no descritas son establecidas: *Chromadorina epidemos*, *Hypodontolaimus pilosus*, *Monhystera ocellidecoris* y *M. dubicola*.

REFERENCES CITED

ANDRÁSSY, I.
1963. The zoological results of Gy. Topal's collectings in South Argentina. 2. Nematoda. Neue und einige seltene Nematoden-Arten aus Argentinien. Ann. Hist.-Nat. Mus. Nat. Hungar., *55:* 243-273.

ALLGÉN, C.
1929. Ueber einige freilebende marine Nematoden von der Macquarieinsel. Zool. Anz., *84*(5-6): 119-126.
1932. Ueber einige freilebende marine Nematoden aus der Umgebung der Biologischen Station auf der Insel Herdla (Norwegen). Mit Anhang: Zur Richtigstellung älterer und neuerer mariner Nematodengenera I. Archiv. Naturgesch. (Neue Folge), *1:* 399-434.
1942. Die freilebenden Nematoden des Mittelmeeres. Zool. Jb. (Syst.), *76* (1-2): 1-102.

CHITWOOD, B. G.
1951. North American marine nematodes. Texas J. Sci., *3:* 617-672.
1960. A preliminary contribution on the marine nemas (Adenophorea) of northern California. Trans. Am. Microscop. Soc., *79:* 347-384.

CHITWOOD, B. G. AND D. G. MURPHY
1964. Observations on two marine monhysterids—their classification, cultivation, and behavior. Trans. Am. Microscop. Soc., *83:* 311-329.

CHITWOOD, B. G. AND R. W. TIMM
1954. Free-living nematodes of the Gulf of Mexico (In: Gulf of Mexico, its origin, waters and marine life). Fish. Bull. (89) U. S. Fish and Wildlife Serv., pp. 313-323.

COBB, N. A.
1920. One hundred new nemas. Contrib. Sci., Nematology, *9:* 217-343.
1928. A new species of the nemic genus *Syringolaimus* with a note on the fossorium of nemas. J. Wash. Acad. Sci., *18*(9): 249-253.

COLES, J. W.
1965. A critical review of the marine nematode genus *Euchromadora* de Man, 1886. Bull. Brit. Mus. nat. Hist. (Zoology), *12*(5): 159-194.

DE CONINCK, L. A.
1943. Wetenschappelijke Resultaten der Studiereis van Prof. Dr. P. van Oye op Ijsland. XIV. Sur quelques espèces nouvelles de nématodes libres des eaux et des terres saumâtres de l'Islande. Biol. Jaarb., *10:* 193-220.

GERLACH, S. A.
1951. Die Nematoden-Gattung *Microlaimus*. Zool. Jb. (Syst.), *79*(1-2): 188-208.
1955. Zur Kenntnis der freilebenden marinen Nematoden von San Salvador. Z. wiss. Zool., 158P 249-303.

GINSBURG, R. N. AND H. A. LOWENSTAM
1958. The influence of marine bottom commmunities on the depositional environment of sediments. J. Geol., *66:* 310-318.

HOPPER, B. E. AND S. P. MEYERS
1966. Observations on the bionomics of the marine nematode, *Metoncholaimus* sp. Nature, *209:* 899-900.

HOPPER, B. E. AND S. P. MEYERS
MS Population studies of benthic nematodes within a subtropical seagrass community. In preparation.
HUMM, H. J.
1964. Epiphytes of the sea grass, *Thalassia testudinum*, in Florida. Bull. Mar. Sci. Gulf & Carib., *14:* 306-341.
KING, C. E.
1962. Some aspects of the ecology of psammolittoral nematodes in the Northeastern Gulf of Mexico. Ecology, *43*(3): 515-523.
INGLIS, W. G.
1962. Marine nematodes from Banyuls-sur-Mer; with a review of the genus *Eurystomina*. Bull. Brit. Mus. nat. Hist. (Zoology), *8*(5): 209-283.
DE MAN, J. G.
1876. Contribution à la connaissance des Nématoides marins du Golf de Naples. Tijdschr. Nederl. Dierk. Ver., *3:* 88-118.
1922. Ueber einige marine Nematoden von der Küste von Walcheren, neu für die Eissenschaft und für unsere Fauna, unter weichender sher merkwürdige *Catalaimus max weberi* n. sp. Bijdr. Dierk. Amsterdam, *22:* 117-124.
MEYERS, S. P. AND B. E. HOPPER
1966. Attraction of the marine nematode, *Metoncholaimus* sp., to fungal substrates. Bull. Mar. Sci., *16:* 143-150.
MEYERS, S. P., P. A. ORPURT, J. SIMMS, AND L. L. BORAL
1965. Thalassiomycetes VII. Observations on fungal infestation of turtle grass, *Thalassia testudinum* König. Bull. Mar. Sci., *15:* 548-564.
MICOLETZKY, H.
1923. Neue freilebende Nematoden aus Suez. Sitzungsber. Akad. Wiss. Wien, mathem. naturw. Kl. Abt. 1, *131:* 77-103.
1930. Freilebende marine Nematoden von den Sunda-Inseln. I. Enoplidae .... nach den hinterlassenen Aufzeichnungen von Prof. Micoletzky herausgegeben von Dr. Hans A. Kreis, Basel (Papers from Dr. Th. Mortensen's Pacific expedition 1914-16. LIII). Vidensk. Medd. Dansk Naturh. Forening Kobenhavn, *87:* 243-339.
MOORE, D. R.
1963. Distribution of the sea grass, *Thalassia*, in the U. S. Bull. Mar. Sci. Gulf & Carib., *13:* 329-342.
PERKINS, E. J.
1958. The food relationships of the microbenthos, with particular reference to that found at Whitstable, Kent. Ann. Mag. Nat. Hist., ser. 13, *1:* 64-77.
PHILLIPS, R. C.
1960. Observations on the ecology and distribution of the Florida seagrasses. Professional Papers No. 2, Fla. State Bd. Conserv., 72 pp.
SANDERS, H. L.
1960. Benthic studies in Buzzards Bay. III. The structure of the soft bottom community. Limnol. Oceanogr., *5:* 138-153.
SCHNEIDER, W.
1932. Nematoden aus de Kiemenhöhle des Flusskrebses. Arch. Hydrobiol., *24*(4): 629-636.
SCHULTZE, MAX
1857. Nematodes. *In*: Carus, J. V. Icones zootomicae. Erste Hälfte: Die wirbellosen Thiere. Leipzig., 32 pp.

SCHUURMANS-STEKHOVEN, J. H.
1935. Nematoda Errantia. *In*: G. Grimpe and E. Wagler (Eds.), Die Tierwelt der Nord- und Ostsee, Teil Vb, 173 pp.
1942. The free living nematodes of the Mediterranean. II. The Camargue. Zool. Mededeel., Leiden., *24*(3-4): 217-228.
1942. The free living nematodes of the Mediterranean. III. The Balearic Islands. Zool. Mededeel., Leiden., *24*(3-4): 229-262.
1943. Freilebende marine Nematoden des Mittelmeeres. IV. Freilebende marine Nematoden der Fischereigründe bei Alexandrien. Zool. Jahrb. (Syst.), *76:* 323-380.
1950. Mediterranean free-living marine Nematodes. I. The Bay of Villefranche. Mém. Musée royal hist. nat. Belg., *37:* 1-220.

STEINER, G.
1915. Freilebende marine Nematoden von der Küste Sumatras. Zool. Jahrb (Syst.), *38:* 223-244.
1958. *Monhystera cameroni* n. sp.—a nematode commensal of various crustaceans of the Magdalen Islands and Bay of Chaleur (Gulf of St. Lawrence). Can. J. Zool., *36:* 269-278.

THORSON, G.
1957. Bottom communities. *In*: Treatise on marine ecology and paleoecology. Geol. Soc. Amer. Mem., *67*, 1: 461-534.

TIMM, R. W.
1951. A note on the cell inclusions of *Syringolaimus smarigdus* Cobb, 1928. Proc. Helminth. Soc. Wash., *18:* 125-126.
1952. A survey of the marine nematodes of Chesapeake Bay. Maryland. Chesapeake Biol. Lab. Publ., *95:* 1-70.
1963. Marine nematodes of the suborder Monhysterina from the Arabian Sea at Karachi. Proc. Helminth. Soc. Wash., *30:* 34-49.

VOSS, G. L. AND NANCY A. VOSS
1955. An ecological study of Soldier Key, Biscayne Bay, Florida. Bull. Mar. Sci. Gulf & Carib., *5:* 203-229.

WIESER, W.
1951. Untersuchungen ueber die algenbewohnende Mikrofauna mariner Hartböden. I. Zur Oekologie und Systematik der Nematodenfauna von Plymouth. Oesterr. Zool. Ztschr., *3*(3-4): 425-480.
1952. Investigations on the microfauna inhabiting seaweeds on rocky coasts. IV. Studies on the vertical distribution of the fauna inhabiting seaweeds below the Plymouth laboratory. J. Marine Biol. Ass. U. K., *31*(1): 145-174.
1953. Die Beziehung zwischen Mundhöhlengestalt, Ernährungsweise und Vorkommen bei freilebenden marinen Nematoden. Ark. Zool. Stockholm, *4*(5): 439-484.
1954. Untersuchungen über die algenbewohnende Mikrofauna mariner Hartböden. III. Zur Systematik der freilebenden Nematoden des Mittelmeeres. Mit einer ökologischen Untersuchung über die Beziehung zwischen Nematodenbesiedlung und Sedimentreichtum des Habitats. Hydrobiologica, *6*(1-2): 144-217.
1955. A collection of marine nematodes from Japan. Publ. Seto Mar. Biol. Lab., *4*(2-3): 159-181.
1956. Eine Sammlung mariner Nematoden aus Piraeus (Griechenland). Oesterr. Zool. Ztschr., *6*(5): 597-630.
1956a. Free-living marine nematodes. III. Axonolaimoidea and Monhysteroidea. Lunds. Univ. Arsskr. Avd. 2, *52:* 1-115.

1959. Zur Ökologie der fauna mariner algen mit besonderer berücksichtigung des Mittelmeeres. Int. Rev. Hydrobiol., *44*(2): 137-180.

1959a. Free-living nematodes and other small invertebrates of Puget Sound beaches. Univ. Wash. Publs. Biol., *19:* 1-179.

1960. Benthic studies in Buzzards Bay. II. The meiofauna. Limnol. Oceanogr., *5:* 121-137.

1962. Die trophische Struktur mariner Kleintiergemeinschaften. Naturwissen. Rundschau, *15*(3): 99-105.

WIESER, W. AND B. E. HOPPER
1967. Marine nematodes of the east coast of North America. I. Florida. Bull. Mus. Comp. Zool., *135*(5): 239-244.